THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVIII. No. 1753.] LONDON, DECEMBER 15, 1896. [48TH YEAR. PRICE 6d.

TUBES AND FITTINGS
FOR
GAS, STEAM, WATER,
AND ALL PURPOSES,
ALSO
COILS OF EVERY SIZE AND SHAPE.

Apply to the Original Firm of
JOHN BROTHERTON
LIMITED,
Imperial Tube Works, Monmore Green,
WOLVERHAMPTON.
ESTABLISHED 1861.

Lanemark Coal Co.,
LIMITED.
LANEMARK CANNEL
AND GAS COALS.
Quotations and Analysis on Application to
LANEMARK COLLIERY,
NEW CUMNOCK, N.B.
Shipping Ports: All the principal Scotch Ports.

— ESTABLISHED 1830. —
PARKER & LESTER,
Manufacturers & Contractors.
THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores, for Gas and Water Works.
WORKS:
ORMSIDE STREET, OLD KENT ROAD,
LONDON.

ROBERT MARSHALL,
CANNEL COAL MERCHANT.
97, WELLINGTON STREET, GLASGOW.
Prices and Analysis of all the Scotch Cannels on Application.

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"ABYSSINIAN" & ARTESIAN TUBE WELLS,
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.
LE GRAND & SUTCLIFF,
HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

WHAT IS THE "MELDRUM" DUST-FUEL FURNACE?
MANY HUNDREDS WORKING AT GAS-WORKS.
Write for Catalogue—
MELDRUM BROS., ATLANTIC WORKS, MANCHESTER.
Also at LONDON, LEEDS, NEWCASTLE, LIVERPOOL, and BIRMINGHAM.

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GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

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PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

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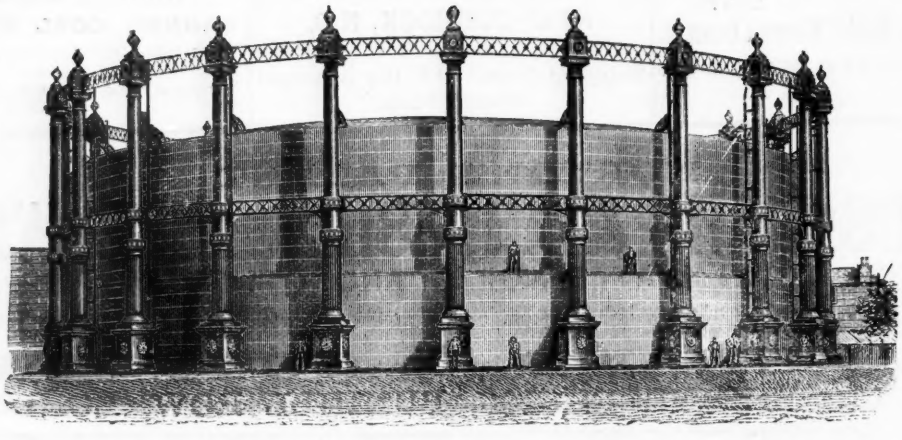

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Estimates for any description of Gas Plant on application.

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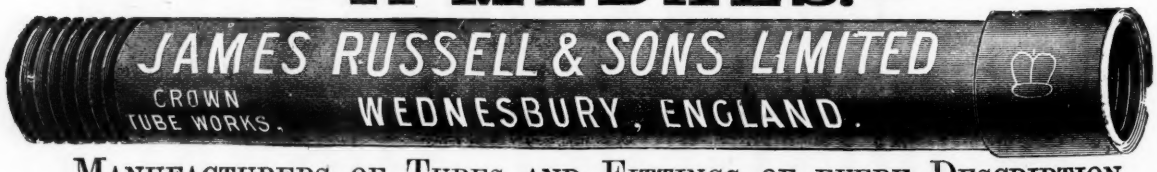

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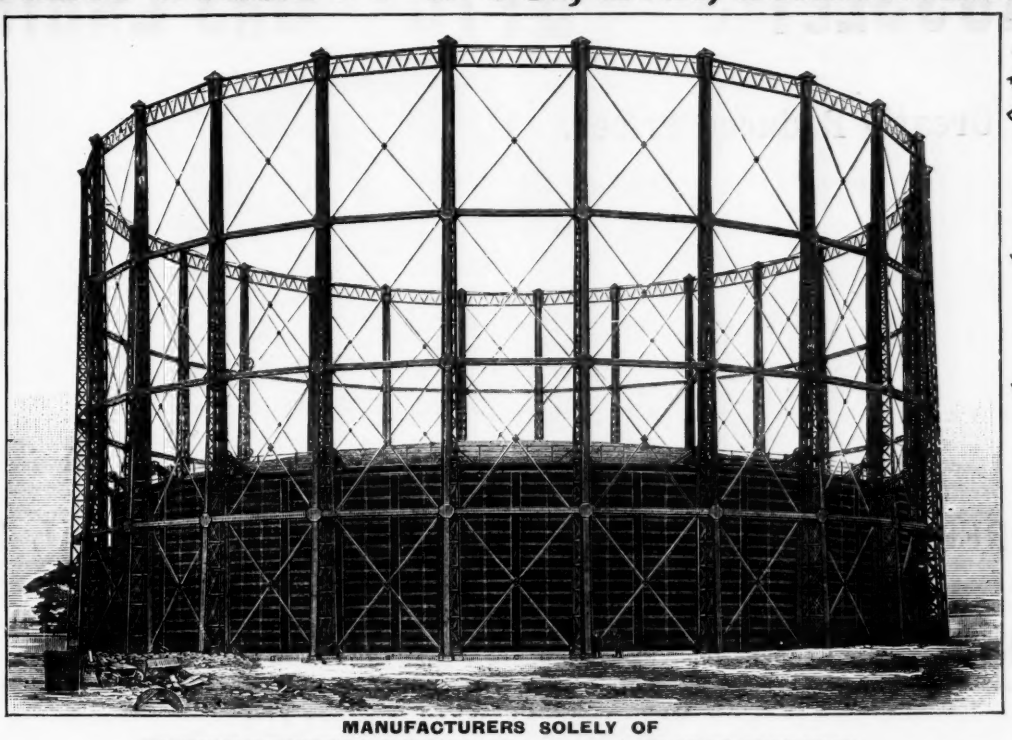

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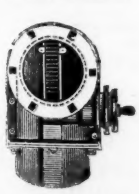

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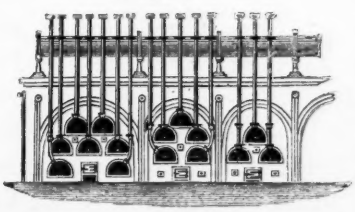

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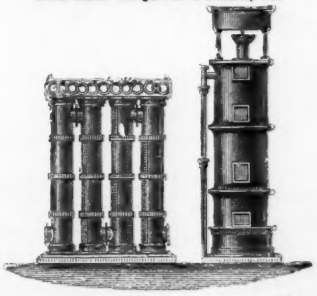

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for working Purifiers,

Also Bye-Pass & Stop Valves

PURIFIERS with Planed Joints,

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS, and SPECIALS.

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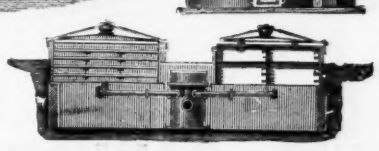

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Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

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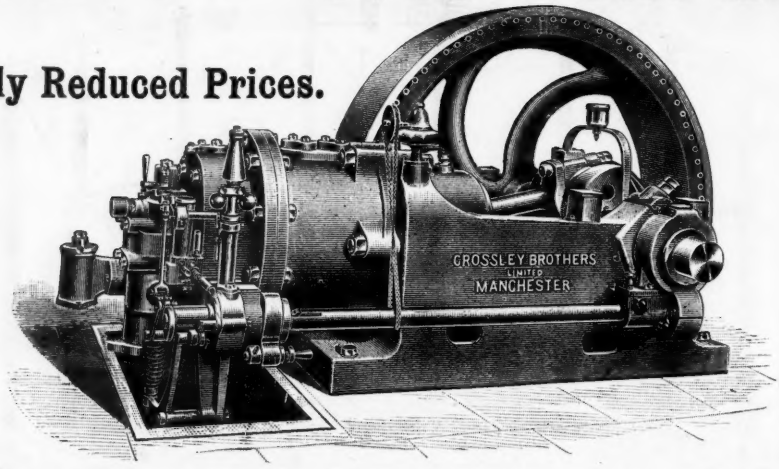
Greatly Reduced Prices.



REPRESENTS NEW TYPE 40-HORSE POWER NOMINAL HIGH-SPEED ELECTRIC-LIGHT ENGINE.

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FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

GLAZED BRICKS AND PORCELAIN BATHS.

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WHEN HE VISITED THE

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"HERCULES"

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INCANDESCENT GAS-LIGHT

(WELSBACH PATENTS).

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Large Reduction in Prices From March 2, 1896, Due to Colossal Sales, And Universal Adoption of the System.

THE GREATLY REDUCED CONSUMPTION OF GAS
Covers the Initial Cost of the Burners in less than SIX Months.

The Prices have been REDUCED as follows:—

The Ordinary "C" Burner, price 6/6
The "C" Bye-Pass Burner, „ 7/6

Prices of other Patterns Reduced Proportionately.

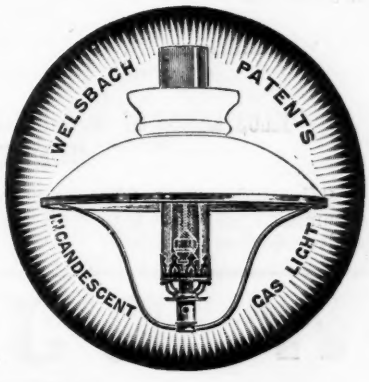
Special attention is called to

The "S" Bye-Pass Burner, price 7/6

which, with a consumption of 2¼ cubic feet of gas an hour, gives

A LIGHT OF 25 TO 30 CANDLE POWER.

This pattern is particularly recommended where it is desired to effect a large saving in gas rather than to effect a great increase in the light.



The attention of Gas Managers and Gas Engineers is called to this System of Lighting as one which tends to Popularize the Use of Gas as an Illuminant, owing to the following Advantages:—

Economy in Consumption of Gas, combined with High Illuminating Efficiency.
Freedom from Smoke, Dirt, and Flickering.
Greatly Reduced Heat.
The combination of High Lighting Power with DURABILITY can only be obtained by The Welsbach System.

The "Lancet" Special Analytical and Sanitary Commission, in an exhaustive report, pronounces the "Incandescent Gas-Light System" to be the Healthiest, Best, and most Economical System of Gas Lighting.

Suitable for every purpose of Inside and Outside Lighting.

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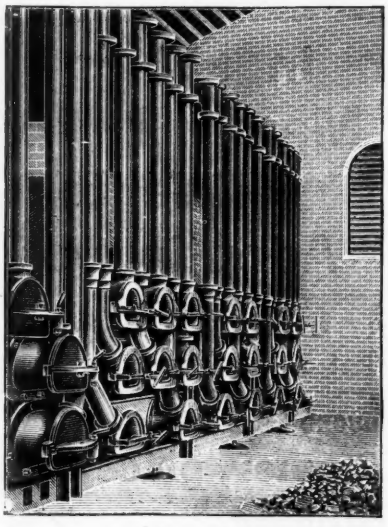
GENERATOR & REGENERATOR FURNACES & SETTINGS

GIVING VERY BEST RESULTS.



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This COMPANY write—

"Mr. Chester's Furnaces and Settings you have erected for us work exceedingly well. Splendid heats under easy control. Nearly **50** per cent. less Coke used for Fuel than formerly. Very convenient for Sunday stopping. Work done in a thorough manner, to our entire satisfaction."

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"The result of using Chester's Furnace and Setting for first Six Months of 1896 was to produce 26,000 cubic feet more gas, using 35 tons less coal, and having 171 tons more coke for sale, compared with same period of 1895."

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"Can make 8000 to 9000 per mouthpiece easily with **Mr. Chester's Regenerators** you have erected for us. Fuel Consumption much less than with our Generators. Heating of Retorts very even. Very well pleased with working. Results exceed expectations."

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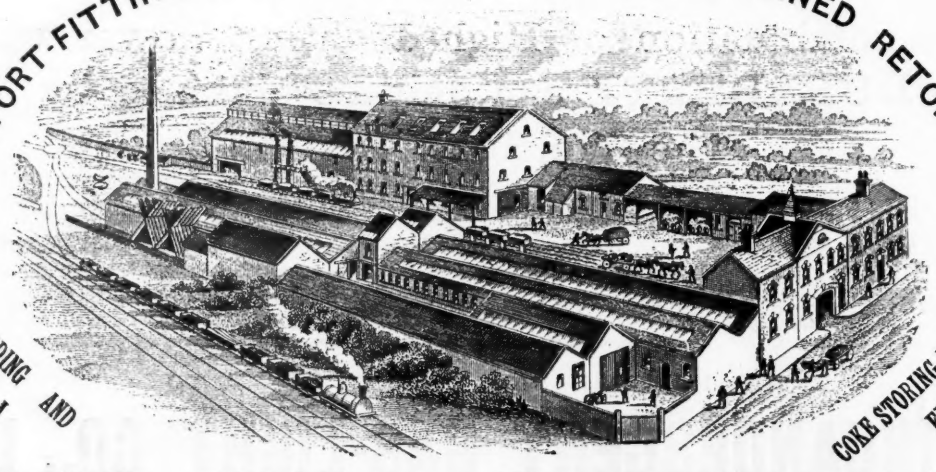
RETORT-FITTINGS, REGENERATOR SETTINGS, INCLINED RETORTS.



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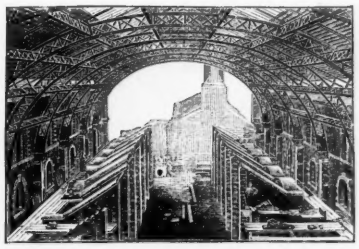

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GAS & CHEMICAL
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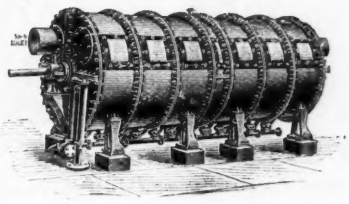
Improved
PATENT SCRUBBER-WASHERS,
All sizes,
From 50,000 to 5,000,000 Cubic Feet of Gas per day.
Results unrivalled. Send for Particulars and Prices.

MALLEABLE
and all Kinds of
CASTINGS.



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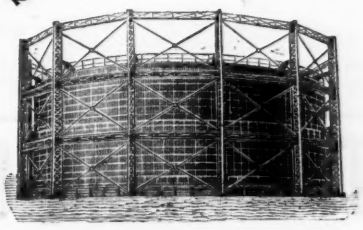
ROOFS, BRIDGES, TANKS, GIRDERS.



Improved
BYE-PASS and
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GOVERNORS,
and METERS.

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EXHAUSTERS.

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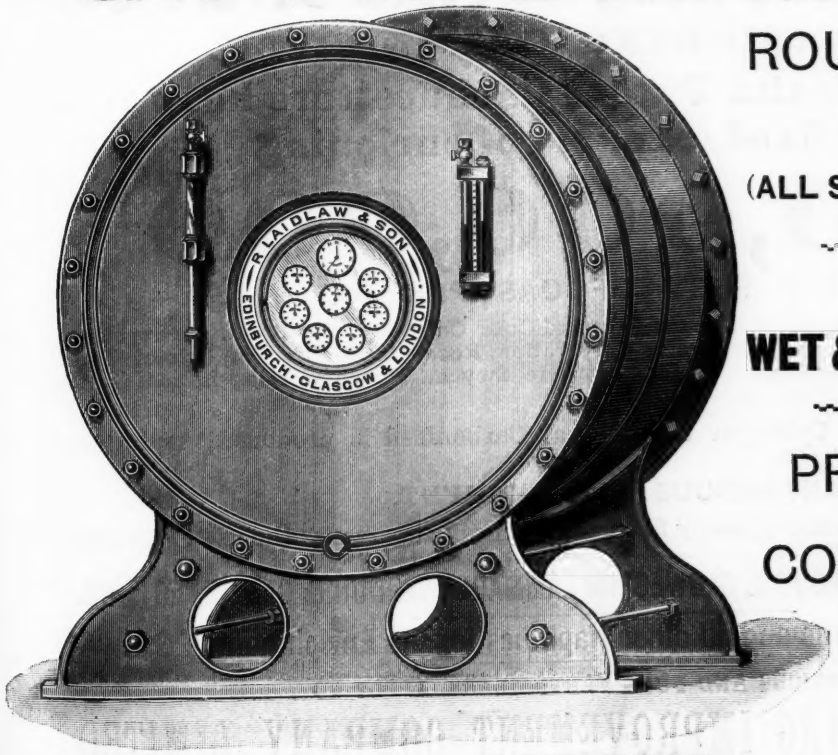

ROUND OR SQUARE
STATION
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CONSUMERS'
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PREPAYMENT
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METERS.

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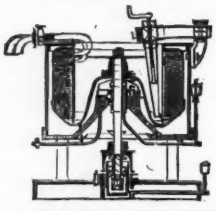
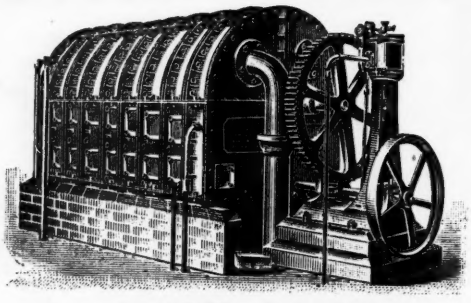


EXTRACTS OVER 99 PER CENT. OF AMMONIACAL LIQUOR FROM TAR.

PATENT "STANDARD" WASHER-SCRUBBER.



OVER **530** MACHINES

In use and in course of Construction.

They extract all the Ammonia and a large proportion of Carbonic Acid and Sulphuretted Hydrogen.

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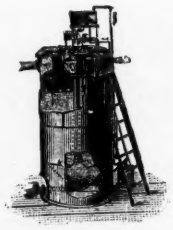

PREVENTS ALL "SCALE" AND SAVES FUEL.

MARSHALL'S PATENT TAR EXTRACTOR AND WASHER.

Extract from letter from the Late Mr. Jabez Church: "The Marshall Patent Tar-Extractor has given very satisfactory results."

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FOR ENRICHING GAS IN BULK.

Over 50 Maxim Patent Carburettors have now been fixed, capable of enriching

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CUBIC FEET OF GAS PER DAY.

Among the Companies supplied are The Gaslight and Coke Company, the South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **FOUR YEARS.**

More Gas and saleable Coke per ton of Coal Carbonized is produced; saving Capital, Labour, Fuel, Wear and Tear, &c.

The Enrichment is **INSTANTANEOUS** and **PERMANENT.**

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

Dealers in Carburine and all other Naphthas for the Enrichment of Gas.

FOR PRICES AND FULL PARTICULARS, APPLY TO

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ARDEN HILL & CO.,

GAS ENGINEERS,

BIRMINGHAM.

No. 1080.

"THE ERA."

(Registered.)

A New Fire, with Circular Front, for this Season.

Has a perfect arrangement to utilize all Products of Combustion

SPECIALLY MADE FOR HIRING-OUT PURPOSES.

No.	Height. Inches.	Width. Inches.	Width of Fire. Inches.	Price, Best Stove Enamel.
1080	29	20	8½	**50s.**
1082	30½	22½	10	**60s.**
1084	31½	25½	13	**70s.**

NOTE.—Prices include New Duplex Burner, Two Brass Lever Taps, and Fittings all complete, which can be had either right or left hand.

NICKEL PLATED TRIVETS . . . . . **2s.** EXTRA.

Sole Makers of the celebrated "ACME" GAS COOKERS used by H.R.H. the Duke of York, CARVING-TABLES, HOT CLOSETS, and JAPANNING OVENS, &c.

THE GAS-METER COMPANY, LIMITED

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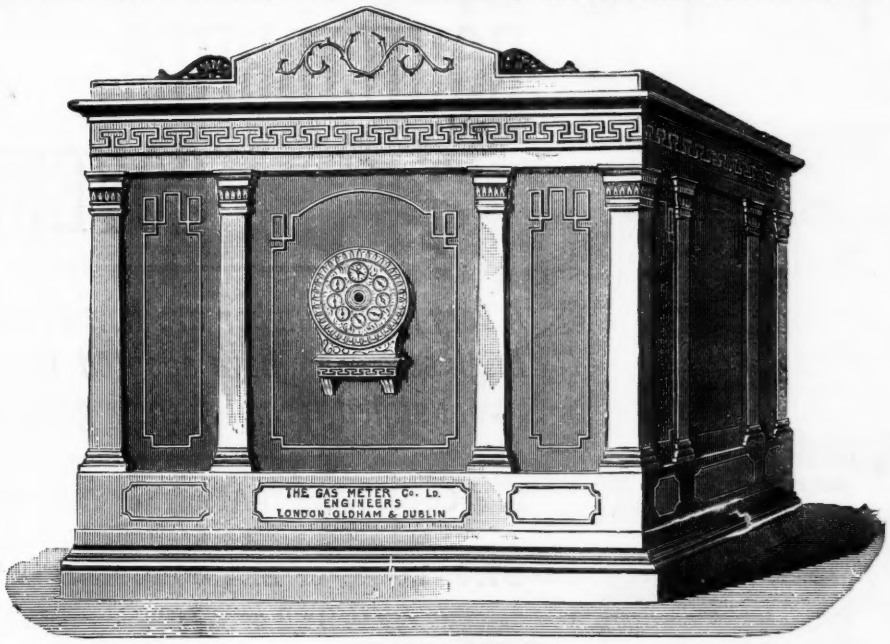
SQUARE STATION METERS WITH PLANED JOINTS.



STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM, LATE WEST & GREGSON. Established 1830.

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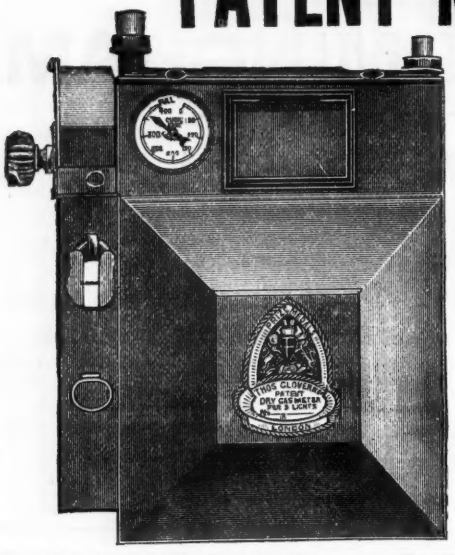
PATENT NEW IMPROVED



PREPAYMENT METER

For Pennies, Shillings, or any Coin.

Simple in Mechanism.
Positive in Results.
Price Changer *in Situ.*

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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE
Last Week's Labour Troubles . . . 1171
The Southport Appeal—The "Approved" Burner . . . 1172
Gas Affairs at Hull . . . 1172
Professor Lewes's Cantor Lectures . . . 1173
WATER AND SANITARY AFFAIRS—
The Prospects of the County Council's Purchase Bills . . . 1173
Mr. Tendron's Address to the Grand Junction Water Company . 1173
Some Features of the Purchase Scheme of the County Council . 1174
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 1175
Electric Lighting Memoranda . . . 1175
The Problems of Power Transmission and Distribution . . . 1176
NOTES:—
Can Calcium Carbide be Profitably Produced by Steam Power? . 1178
The Limits of Electric Power Transmission . . . 1178
The Standard of Light for Reading . . . 1178
TECHNICAL RECORD:—
Society of Arts—Domestic Illumination by Means of Gas. Concluding Lecture by Professor Vivian B. Lewes, F.I.C., F.C.S. 1178
American Gaslight Association—Annual Meeting at St. Louis. . 1182
Mr. F. J. R. Carulla on the Position of Sulphate of Ammonia . 1183
The Use of Acetylene for Motors . . . 1184
REGISTER OF PATENTS:—
Pipe-Joints for Water-Taps, &c.—Thomas, O., and Dyer, J. H. . 1185
Gas Heating Apparatus—Schoonjans, G. . . . 1185
Charging Air with Combustible Matter and Applying it for Illuminating—Denayrouze, L. . . . 1185
Valves for Gas and Water Pipes—Preston, E. J., and Cornish, A. T. 1185
Street-Lamps—Loftus, Sir A. J., and Rowlands, E. . . . 1185
Revivifying Spent Lime—Hislop, G. R. . . . 1185
Gas-Burners—Williams, W. B. . . . 1186
Igniting Devices for Gas-Burners—Schwarzschild, A. . . . 1186
Increasing the Illuminating Power of Gas under Combustion—Lavender, R., and Tice, W. . . . 1186
Making Generator Gas—Dowson, J. E. . . . 1186
Regenerative Gas-Lamps of the Wenham Type—Robinson, S. H. 1186
Air-Carburettor—Pengeot, A. . . . 1186
Lighting Incandescent Gas-Lamps—Grosch, R. . . . 1186
Gas or Vapour Engines—Baker, H. C. . . . 1187
An Acetylene Supplied Street-Lamp—Clarke, W. C. . . . 1187
Incandescent Gas-Burners—Gabel, R. . . . 1187
Incandescent Gas-Burner Mantles—Wellstein, H. . . . 1187
Incandescent Gas-Burners—Bode, P. . . . 1187
Mounting Incandescent Gas-Burner Mantles—Lake, H. H. (Sieverts, W. H. A.) . . . 1187
Patent Notices . . . 1187
CORRESPONDENCE:—
Professor Lewes on the Illuminating Power of Various Burners—The Advantage of Offering New Stock to Gas Consumers—Motor Carriages—Choked Ascension-Pipes . . . 1188
LEGAL INTELLIGENCE:—
High Court of Justice—Chancery Division—*In re* the Incandescent Gas-Light Company's Patents . . . 1189
High Court of Justice—Queen's Bench Division—Mayor and Corporation of Southport *v.* Birkdale Urban District Council. 1189
The Charge of Embezzlement against a Collector; A Bogus Gas Collector; Embezzlement by a Gas Collector. . . . 1190
MISCELLANEOUS:—
Southport Corporation Gas Supply—The Proposed Reduction in the Illuminating Power and Price of Gas . . . 1191
The Matlock Bath Gas Arbitration—The Award . . . 1192
The Proposed Purchase of the Kingston-on-Hull Gas-Works by the Corporation . . . 1192
The Lowestoft Gas and Water Works Purchase Question . . . 1193
Gas and Water Works Extensions at Falkirk . . . 1193
Sale of Stocks and Shares . . . 1193
The Proposed Municipal Gas Supply for Vienna . . . 1193
Electric Lighting Notes . . . 1194
The London County Council and the Water Question. . . . 1196
Meeting of the Grand Junction Water-Works Company . . . 1197
The Water Question at Sheffield . . . 1198
Heywood Corporation and the Water Supply to Middleton . . 1199
Notes from Scotland . . . 1199
Current Sales of Gas Products . . . 1200
Coal Trade Reports . . . 1201
Gas and Water Companies' Stock and Share List . . . 1201
PARAGRAPHS:—
OBITUARY: Mr. John Weir; Mr. Ephraim Randell; Mr. Joseph R. Thomas . . . 1177
PERSONAL: Mr. G. Spurgen; Mr. J. Goodwin; Mr. Frank Roberts; Mr. F. Niven; Mr. J. Budd; Mr. F. Bathurst . . 1177
Received—The Voting on the London County Council's Water-Works Purchase Bills—Mr. E. T. Hooley and the Incandescent Gas-Light Company. . . . 1174
Gas-Engines in Central Europe—The Supply of Electricity in England and America—Proposed Reorganization of the Local Government Board—The Transactions of The Gas Institute . 1177
The Gas Production of Berlin . . . 1184
The Rhymney Water Schemes . . . 1187
The Portsea Island Gas Company to be Summoned for Supplying Gas of Deficient Illuminating Power—Fatal Gas Explosion. . 1188
The Cost of Softening the St. Helens Water Supply—East Grinstead Gas and Water Works—Incandescent Gas Lighting and Oil Gas Enrichment at Bradford—Projected Improvements at the Sandwich Gas-Works . . . 1190
The Proposed Municipalization of the Maidstone Water-Works—The Water-Works Purchase Question at Chichester . . . 1192
The Southbank Gas Explosions—A Gas Explosion Attributed to Incandescent Gas-Lamp Bye-Passes—The Price of Gas at Alton 1194
Petroleum Incandescent Lamp Company, Limited—The Gas Supply of Cranbrook—Wokingham Corporation Gas-Works . 1196
Incandescent Gas Lighting at Princes Risborough—The Proposed Purchase of the Torquay Watersheds . . . 1199
Proposed Gas-Works at Box. . . . 1200
Accrington's Water Supply—Periodical Stoppages in the "Constant" Supply of Water at Salisbury . . . 1201
Reduction in Price—A New Reservoir for Horwich—The St. Anne's Gas-Works Purchase Question—Kirkby Lonsdale Gas-Works Purchase Question—Gas-Meter Rents at Accrington—Fatal Explosion of Acetylene in Berlin—The Charge for Water for Gardens—East Stonehouse Water Supply . . . 1202
The South Molton Corporation and the Gas-Works—The Deal and Walmer Water Board—The Public Lighting of Morecambe . 1203

EDITORIAL NOTES.

Last Week's Labour Troubles.

For lack of other matter, the newspapers last week tried hard to get up a little excitement over the action of the General Manager of the London and North-Western Railway Company in clearing out a few disaffected employees who had confessed that, in the event of a dispute, they would obey the orders of the Trade Union rather than those of their employers. The incident has illustrated over again the hopeless character of the New Union movement. There has been in existence for some years an organization of this kind, calling itself the Amalgamated Society of Railway Servants; and during the time of the last Administration, when the Home Office and the Board of Trade were peculiarly susceptible to Trade Union influence, the officials of this particular Society were first and foremost in urging the Government not to allow employers to contract out of the proposed new Employers' Liability Act. A great fuss did these individuals make; and bitter was their opposition to the idea of permitting the private arrangements of employers such as the London and North-Western Railway Company and the South Metropolitan Gas Company, albeit better for the men than any statutory protection, to remain outside the new Act. The circumstance that the whole strength of the Union in question never approached a quarter of the number of men employed by the London and North-Western Company alone, did not prevent the officials from posing as the mouthpieces of the whole railway world, or the popular newspapers from taking them at their own valuation. Time passed, however, and with a change of Government the question of "contracting out" assumed another phase. The various and sundry amalgamated Trade Unions also fell for awhile into something like their proper insignificance, until the general revival of trade during the past and present season gave the agitators another opportunity, of which Messrs. Mann, Tillett, and Co. have tried to avail themselves at the earliest possible moment. Not to be behindhand, Mr. Harford, General Secretary of the Amalgamated Society of Railway Servants, began last month to hold meetings and send paragraphs to the cheap newspapers, hinting that trouble was brewing in the railway service. This artless bit of "advertisement" quickly had an effect that was never intended; for the management of the London and North-Western Railway investigated the matter, and, discovering that a small contingent of malcontents in the service were disposed to look to Mr. Harford as their master, promptly struck while the latter were only talking of striking, and turned them off to agitate, if it so pleased them, outside. This promptitude spread astonishment and dismay among the would-be strikers, who would naturally have preferred to choose their own time for making themselves disagreeable; and they were much upset at discovering that their proposed game was one at which two sides can play. Of course, all the newspapers which were willing to approve of the men's saying to their employers, "If you do not "satisfy us, we will strike," were virtuously indignant at the employers for being too quick, and saying in effect to their dissatisfied servants, "You do not please us, and may "therefore depart."

There was a good deal of discussion last week about the position thus created, and even "The Times" thought the action of the Railway Company rather hard upon the men who had been dismissed. The management, however, knew well what they were about. They gained their end, which was to notify to Mr. Harford and his associates and supporters that there must be no divided allegiance in the service. The sharp dismissal of a handful of men, taken from different parts of the system, was the equivalent of Bonaparte's "whiff of grapeshot" for dispersing the mob before the emergency became serious. Now the Company can afford to be magnanimous, and reinstate the discharged hands, in the complete assurance that Mr. Harford's power for mischief has been destroyed so far as their interests are concerned. There will be no strike of railway men this Christmas time; but if Mr. Harford's vapourings had not been so quickly dispelled, there is no knowing what they might have done. It is necessary to protest in the strongest possible manner against the folly, of which several newspapers have been guilty, of publicly

rejoicing over the merciful reinstatement of the dismissed railway men, as constituting a "climb down" on the part of the Company. If every little concession of this kind is to be pounced upon and trumpeted about as a victory of the forces of disaffection, then good-bye to all consideration by employers of the individual interests of the misled victims of the professional agitators. It has been part of Mr. Harford's "book" to prime the newspaper reporters with the notion that he has had everything to do with the settlement of this affair, so far as it has gone. But careful reading of the published accounts of the proceedings at the Board of Trade last week will show that, while Mr. Harford was compelled to admit that the Company had reasonable grounds for supposing that a strike of their servants, or some of them, was in contemplation, he was personally kept at arm's length by the General Manager of the Company, and did not make the slightest progress towards the realization of his aim of getting the Union recognized. The Company never yielded a fraction of their expressed determination not to permit the interference of a third party between them and their servants. It is a small exercise of magnanimity on the part of such employers to pardon and take back a few hands who had momentarily forgotten upon which side their bread was buttered. But it will be an evil day for England if every industrial compromise is to be branded as weakness out of which somebody may make political capital.

What this miserable ineptitude must lead to is to be seen even now in the case of the Hamburg strike, which is being fought out to the bitter end because it has become known that the politicians who fomented the disturbance have given the instruction that the men are to accept any —even the smallest and most insignificant—concession by the employers as a "victory" of their cause. Consequently, there will be no "golden bridge" constructed for anybody at Hamburg. The masters are going to carry on the fight to a finish which shall not leave room for the smallest uncertainty as to who has won. This may appear cruel; but it is the only way to deal with professional agitators who do not speak the truth, and with slippery organizations which exert power, but have no responsibility, and cannot be trusted to run straight from one day to another. Meanwhile, it is becoming clearer every day that Mr. Tom Mann did no good either for himself or for anybody else by his intermeddling at Hamburg. There was something contemptuous in the good-humoured way in which he was treated by the authorities of the port. After his return, he declared that he had by his own address achieved one of the objects of his visit—making an inspection of the harbour. The latest independent account is that he "was shown all over the harbour, and when, finally, he "was shipped off to Grimsby, it was with paternal advice "not to come back to Hamburg on an agitating expedi- "tion, otherwise he really would have to be punished." Work at Hamburg is reported to be going on; and the prospects of the strikers are stated to be growing gloomier every day.

The Southport Appeal—The "Approved" Burner.

ELSEWHERE we report the result of the interesting appeal on the Southport case which raised the question of the proper meaning of the term "approved burner" in the Private Act regulating the gas undertaking of the Corporation. It will probably be remembered that last June the Corporation were held by the Magistrates to be bound to supply the adjoining district of Birkdale with 20-candle gas, according to tests made with a 15-hole argand burner as specified in the Act, in default of agreement between the parties for the substitution of a different burner. That is to say, the Magistrates held the word "approved" in this connection to mean "agreed." The Corporation view was that the same word meant exactly what it said, according to the ordinary acceptation; and that it was competent for them to approve of the use of any test burner which might from time to time be found most suitable and proper for the purpose. The Magistrates stated a case for appeal, which came last Wednesday before Justices Wills and Wright, when Mr. J. Fletcher Moulton, Q.C., led a formidable team of Counsel for the appellants; Mr. Horridge representing the respondents. To put it as briefly as possible, Counsel's arguments revolved round the point of whether the word "approved" in the section meant anything or nothing; and, in giving judgment, Mr. Justice Wills confessed that a difficulty had been created by the insertion in the Act of a word to the meaning of which no special consideration had apparently been given. Still, the word being where it was, it must be assumed to have some meaning, which it was for the Court to construe. If it could be safely concluded that the word used in this example of vague drafting is meaningless, then it could be ignored, and Southport gas would be left with the 15-hole argand test burner pure and simple. The Court thought, however, that it could not adopt so extreme a view, inasmuch as it was possible to attach a meaning to the word which falls within what may be reasonably regarded as the general purport of the enactment. There is nothing in the Act to give the Birkdale District Council, or any other consumers of Southport gas, a *status* enabling them to agree with the undertakers upon a test burner. Consequently, the theory of the respondents falls to the ground. On the other hand, it cannot be held that the Corporation supplying the gas are to be the sole judges of what is the right and proper burner for testing it. If the original burner is susceptible of being changed for another one, it can only be, in the judgment of the Court, for something analogous to it—for some fair equivalent which shall be for the time being what the 15-hole argand was at the time of its adoption. The rights of Birkdale in the matter are defined to consist in having supplied within their own district gas which shall there satisfy the same test, whatever it may be, which is approved for Southport.

If we may be permitted to say so, this decision appears to be equitable, having regard to the wording of the Act and the facts of the case. Unhappily, there is a doubt as to whether it finishes the litigation. If the conviction appealed from is a criminal matter, as Mr. Justice Wills thinks, then nothing further can be done. If it is not, as to which Mr. Justice Wright has grave doubts, then there is a right of appeal which will probably be exercised. It is a great pity that there should ever have been a loophole left for such costly and unsatisfactory litigation by the use of unconsidered words in an Act of Parliament. This is a lesson that should not be wasted upon those whom it may concern. It is only too true that the trick of employing qualifying words and conventional expressions in documents of serious import is very general, and is fraught with possibilities of mischief such as those who fall into this weakness do not dream of. How hopeless it seems to expect Acts of Parliament to state precisely what they mean, and to mean exactly what they say; and if this complaint is justified in regard to these laborious compositions, how much more does it apply to those writings upon the integrity of which so much in the ordinary business of life depends! Even if the judgment of the Appeal Court in the present instance stands, the door is not shut to further litigation. It apparently leaves with the Southport Corporation the initiative of changing their old and obsolete test burner for a better one—say, the Preston argand. Birkdale can follow suit, and use the same means for seeing that it gets the 20-candle gas delivered into its district. It is, however, open to Birkdale to take proceedings as before for obtaining a decision as to whether any test burner adopted by Southport is a fit and proper burner, in the light of the judgment; and then the Court would have to hear evidence and decide the point upon the balance of competent opinion.

Gas Affairs at Hull.

THERE is just now a movement on foot for the acquisition by the Hull Town Council of the undertaking of the Kingston Gas Company, and which will in all probability eventuate in some interesting proceedings before the Bill of which the Corporation have given notice becomes an Act of Parliament. Negotiations have been going on for some time between the Corporation and the Gas Company; and at the last meeting of the Town Council, Alderman Massey, as Chairman of the Committee which has had this business in hand, moved the adoption of the minutes recommending the purchase of the undertaking at the agreed price of £92,500. The Alderman did his work remarkably well; and, unless we are greatly mistaken, the people of Hull will be with him in this matter, notwithstanding the opposition offered by a few members of the Council who apparently do not know a good thing when they have it put before them. The gas supply of Hull is a rather peculiar affair, owing to the existence of three local Companies—the Kingston Company,

now proposed to be bought out; the undertaking of the British Gaslight Company; and the Sutton, Southcoates, and Drypool Company. The oldest of these is the Kingston Company, whose Act of Incorporation is dated 1821; and they have not been in Parliament since. There is a share capital of £17,000, of which £13,500 is paid up; and the dividend, as given in the latest return, was 20⅛ per cent. The loan capital amounts to £4250. The profit for this year, according to Alderman Massey, was £4805. The nature of the undertaking is indicated by the total length of mains being only 6½ miles. It is a unique concern, occupying a small area "within the docks," as the local term has it; and the works are at the back of the Town Hall. Hull has never been anything else than a working town; and when the old Gas Company started, it was quite natural for the Directors to put the works right in the heart of the district. But though Hull is as busy a place as ever, it is felt to be quite time that the old gas-works were cleared away. The Corporation intend, if they get their Act, to demolish the works, and make some needed street improvements on the site—supplying the consumers with gas purchased in bulk from one of the other Companies. The great advantage to the town from such an arrangement is so conspicuous, that the only wonder is how it can be opposed by anybody in the Council. The Company have accepted a remarkably low offer for their property; and if the Corporation do not stand by the bargain, there is no reason why the shareholders should complain. Alderman Massey is correct in holding that, if the undertaking were valued by arbitration, the figure would probably be higher than the agreed price, to which the costs would have to be added.

At the recent Council meeting, while both those who supported the purchase scheme and those who opposed it spoke with a praiseworthy solicitude for the public interest, some of the latter did not realize the situation. Alderman Massey was accused of trying to rush the scheme through without allowing time for its proper consideration. But the acquisition of the property in question and the extinction of the gas-works in the Old Town have been a point of local politics for years; and it need not take five minutes to form an opinion respecting the acceptability or otherwise of a bargain of this kind. Yet it needed a threat of resignation to enable Alderman Massey, whose treatment of the business was masterly throughout, to get the Council to accept the minutes of the Committee. Averse as we are, on general principles, to the municipalization of gas undertakings when this can be avoided, we cannot see any reason for the continued independent existence of the Kingston Company and the little works in the Old Town of Hull. The Company have been shut in for years without hope of deliverance; and the day for such small gas manufacturing establishments in connection with the supply of a town like Hull is past. However well such works are managed, they cannot do justice either to their proprietors or the public. The consumers in the district would do better if the area were handed over to the British Gaslight Company, who would charge them 2s. instead of 2s. 8d. per 1000 cubic feet which they will have to pay under the Corporation scheme. But such an arrangement appears to be out of the question.

Professor Lewes's Cantor Lectures.

THE course of Cantor Lectures on "Domestic Illumination by Means of Gas," just delivered at the Society of Arts by Professor Vivian B. Lewes, and reported at length in the "JOURNAL," are the latest available teaching concerning the large number of important topics dealt with by the accomplished lecturer. It is unnecessary now to pay compliments to Professor Lewes upon his engaging style, or to recommend to the admiration of our readers his wide learning and splendid gift of demonstration. Wherever English gas lore penetrates, there Professor Lewes's reputation as a popular lecturer on the chemical aspects of gas is also known. The last course of lectures do not exhibit any falling off so far as the power of the lecturer to interest and inform is concerned; but they cannot be said to contain very much novel matter. The incandescent gas-burner holds the field; and beyond this there is for the present nothing much to be said concerning the domestic use of gas for lighting. Yet Professor Lewes has managed to put together his tale of lectures; concluding, as might have been expected, with a full statement of the case for acetylene—which is, to all intents and purposes, a "light of the future." Whether or not the manifold difficulties that surround the proposed use of acetylene as an illuminant will be speedily cleared away, is a problem of which we have no solution at present. We cannot see much chance for acetylene in the great industry of gas lighting; but in the multiplicity of minor applications to which such gas as the Pintsch product lends itself, and for which a richer gas would be still more suitable, there may be a wide field for the newest of illuminants. What Professor Lewes has to say about carbide of calcium and acetylene may be profitably collated with Mr. James Swinburne's observations on the same subject. It is to be remarked that a grim commentary on the text of the last lecture is reported from Berlin, where an unfortunate inventor and several of his assistants lost their lives on Saturday by an acetylene gas explosion.

WATER AND SANITARY AFFAIRS.

THE ratepayers have no less reason than the Water Companies to deprecate the attitude maintained by the London County Council on the question of the Metropolitan Water Supply. At their meeting last Tuesday, the Council, by a small majority, approved the eight Purchase Bills by which the Companies are to be bought out. Already the affair assumes the shape of a *fiasco*. If the Council, in their own "Parliament" at Spring Gardens, can only obtain a majority of seven to approve of their Water Bills, how can they expect to carry these measures in the Parliament of the nation? Amendments, well understood to be fatal to the Bills, were only warded off by a miserable majority of two. Other amendments were got rid of by being declared contrary to those mysterious and irresistible decrees known as the "Standing Orders." Even the majority of seven on the main question was to some extent fictitious. The vote of Mr. Marks in support of the Bills was an enigma, preceded as it was by a speech in which he asserted that the course taken by the Council with regard to these measures "seemed like flying in the "face of Providence." They were "daring Parliament to "hold its own view against a very narrow and insidious "majority of the Council." Had Mr. Marks not voted with those who are thus throwing down a challenge to Parliament, the majority approving the Bills would have been reduced to five. Sir Harry Poland and Mr. Boulnois abstained from voting, or the majority would have been smaller still. With such a shattered force, how can the Council think to make an impression on the Legislature, and to levy an attack by which they shall capture the water supply of the Metropolis? "The Times" asserts that "the majority of the Council must know perfectly "well that their Bills—even if they were less open "to serious objection than they actually are—have no "chance of being carried through during next session." Hence the costs incurred in promoting such Bills are declared to be "simply money thrown away;" and it is intimated, truly enough, that the expenditure is "likely "to amount to no inconsiderable sum." The enterprise is rendered the less hopeful, after the revelations by which the public have been startled in connection with the Works Department. Parliament, we may readily believe, "is now less likely than ever to confer upon the County "Council the unrestricted control of the whole water "supply of London and the surrounding districts." For the surrounding districts, the Council have no desire; but the Government, the Legislature, and also the Royal Commission, have held to the view that the Water Authority should control "Water London," not merely dominate the fractional part known as the "Administrative County."

The Progressives of the London County Council, who claim to be the general benefactors of mankind, must be rather startled by the statement of Mr. F. Tendron that they have been opposed to everything that was for the good of the consumers. Such was the indictment launched from the chair at the meeting of the Grand Junction Water Company last week; and there are facts enough to sustain it. The Progressive party are responsible for the recent scarcity of water in East London; and if they could have had their way, they would have overthrown the Staines reservoirs scheme. In fact, we have only to imagine

them successful in opposing the various Bills of the Water Companies in the last two or three years, to have before us a picture of a great part of London and its outskirts, sooner or later, in the direst straits for lack of water. In addition to these obstructive tactics, prejudicial to the interests of the consumer, the Progressive party have their aggressive policy as directed against the Water Companies. While the ratepayers have to regret the enormous expenditure about to be incurred by the Council in promoting the eight Purchase Bills in Parliament, the Companies have cause to complain of the heavy costs forced upon them in defending their interests when the Bills go before a Select Committee. In this matter, the public suffer along with the Companies—a principle very forcibly illustrated by another circumstance. The Rivers Committee of the London County Council have drawn up a report referring to the avowed intention of the Thames Conservators to charge the cost of certain flood works against the sum of £5000 which the three specified Water Companies are to pay them under the Staines Reservoirs Act. The Committee object that the £5000 so to be paid "is indirectly "paid by the water consumers of London," whereas the burden ought to fall on the Thames Valley Drainage Commission. But the Council fail to perceive that the enormous costs thrown upon the Companies in defending themselves against hostile Bills in Parliament are also a tax laid upon the water consumers of London. This is especially true in the case of the West Middlesex Company, already paying a dividend of 10 per cent., and allowing the consumers a share in the profits. Sir John Lubbock charges it on Lord Onslow that he fails to realize "the great share which the ratepayers already "possess in the Water Companies." The community of interest is certainly more than most people imagine; and a change to the *régime* of the County Council offers nothing in the shape of a rebate. Another financial element is that of the assessment to the rates; and Mr. Tendron has forcibly shown that when the assessment is put up at the quinquennial revision, the additional amount paid by the consumers to the Company is less than the extra sum contributed by the Company to the rates. In the case of the Grand Junction Company, the income is augmented to the extent of £1500 per annum; but the increased rates are more than £3000. There are other matters of finance in Mr. Tendron's able address which are not often heard of, but which claim attention outside the circle of the shareholders.

Among the Purchase Bills of the London County Council with reference to the water supply, those which affect the Grand Junction, West Middlesex, and New River Companies have a special clause, amending the Staines Reservoirs Act of the present year. It is thus provided, in the Bill for the acquisition of the Grand Junction undertaking, that, after the date of transfer of the undertaking to the Council, and until the Council shall have acquired the undertakings of the West Middlesex and New River Companies, the three persons to be nominated on the Staines Reservoirs Joint Committee by the Council, as transferees of the undertaking of the Grand Junction Company, "need not be Directors of that Company." After the transfer of the three undertakings to the Council, the Staines reservoirs guaranteed debenture stock, as far as it is then issued, is to become a liability of the Council. That part of the Staines Act which relates to the Joint Committee is to be repealed, as also that part which specifies the proportion in which the three Companies are to be entitled to the stored water. Finally, the Staines Act is to be read and have effect as if the Council had been named therein instead of the Joint Committee. There may be nothing but what is necessary in these provisions; yet if it were possible to conceive that Parliament would sanction the Purchase Bills, a feeling of regret might very well ensue at the prospect of the Staines reservoirs scheme being entrusted to a body which has so strenuously opposed it. In other respects, the Bill dealing with the Grand Junction Company corresponds to the general tenor of the Purchase Bills. There is a provision that the sinking fund held by the Chamberlain of the City of London under the Acts relating to the Grand Junction Company shall be applied in aid of the purchase of the undertaking.

A feature of considerable interest in the County Council scheme with respect to the Water Companies, though it has been heard of before, consists in the provision for establishing a Water Committee, forming a link between the Council and the Corporation. This Committee is to consist of forty-eight members, or such other number divisible by eight as shall be agreed upon from time to time. One-eighth of the members of this Committee are to be appointed by the Corporation, and the remaining seven-eighths by the Council from among themselves. The body thus constituted is to be a Committee of the Council, and is to have delegated to it, "absolutely and "without reference to the Council," all the administrative and executive functions of carrying on the supply of water from any works acquired, taken on lease, or constructed by the Councils. It is, however, provided that the Water Committee shall not have power to do certain things, such as purchasing, selling, or letting on lease any of the works, constructing new works, or enlarging old works so as to involve capital expenditure. Another restriction is as to "fixing or altering the rates leviable for water, or the "principle of charging or levying rates in respect of water "supplied." A part of the purchase scheme possessing peculiar importance is that which relates to the outer areas. The Bills not only make provision for the sale or transfer to the local authority of such works as are exclusively appropriated to the supply of an outer area, but also for the sale or transfer of any other part of an undertaking which in the opinion of the Council "is not "at the time of the sale or transfer required for the present "or future supply of water to London." Any joint right or interest in such part of the undertaking may be treated in like manner. Power is sought whereby to lease any portion of the undertaking, or to supply water in bulk to the local authority, who are to have the right to compel the Council to surrender that part of the works which supplies the district of the authority—the purchase price to be settled by arbitration if not by agreement. In the meantime, the Parliamentary Committee are conducting negotiations with the outside authorities, in the hope of arriving at agreements with them before the Bills reach the Committee stage in the House, when it will be possible to put forth the requisite amendments. Some other leading features of the Purchase Bills have already been discussed in our columns.

Received.—Report of Proceedings at the Thirty-fifth Annual Meeting of the North British Association of Gas Managers, held in Edinburgh, July 22 and 23, with lists of members, rules, &c., of the Association, together with the Statistical Report of the Gas Supply of Scotland from July 31, 1895, to Aug 1, 1896.

The Voting on the London County Council's Water-Works Purchase Bills.—Our contemporary "London" points out that the voting on the water question at the meeting of the London County Council last Tuesday was not strictly on party lines. In the first division, which would have made purchase permissive and not compulsory, Colonel Hughes voted with the Progressives. But Sir H. B. Poland and Mr. Boulnois, both Directors of water companies, abstained; and the Progressives had a majority of two. In the second division—an amendment which would have given the power of veto into the hands of a minority of the Council—no Moderates voted with the Progressives; but they again carried their point with the same majority. On the final division, sanctioning the Bills, there was a majority of seven, which included Mr. H. H. Marks, M.P., who had previously voted with his party. Mr. Marks announced his intention of supporting the Bills because he wished the Council to appear before Parliament with a definite purchase policy. At the same time, he protested against the way the Committee were rushing the matter. In this division, again, Mr. Boulnois and Sir H. B. Poland abstained from voting.

Mr. E. T. Hooley and the Incandescent Gas-Light Company.—Rumours were current in the City last week that Mr. E. T. Hooley had bought up the Incandescent Gas-Light Company for £1,500,000, with the view of bringing it out as a new concern with a capital of £2,000,000. It had been known that Mr. Hooley's brokers had been busily engaged in acquiring shares in the Company; and the effect of the purchase rumour was a sharp rise in value. When the official list closed on Wednesday, they stood at 1¾; but there was an advance to 2$\frac{7}{8}$. Referring to the matter last Saturday, the "Financial News" stated authoritatively that, though Mr. Hooley had expressed his willingness to give £4 a share for the concern, nothing had been decided. The present capital of the Company is £500,000, in £1 shares, quoted at 2½; and the profits have risen from £6592 in 1893 to £144,852 in the year ending March 31 last. For the nine months which have since elapsed, they have been £220,000, or at the rate of £275,000 per annum. Our financial contemporary thinks that if Mr. Hooley is willing to give £4 apiece for the shares, they must be worth more than the price quoted; and this is apparently the view of those who have been buying in the market.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1201.)

THE past week had a rather chequered existence on the Stock Exchange. It began in a very dull mood, without a ray to cheer it. The railway position at home was most distressing, for it looked as if it was going to be treated with more temper than judgment; foreign affairs were not cheering; and the great mining market was in a poor way. But the happy settlement of the railway trouble, and a general clearing of the atmosphere, brought about a much happier close. Business, however, was much restricted in point of volume, as is usually the case at this time of year; and no revival of activity is to be expected until after Christmas. On the whole, notwithstanding the early depression, prices are for the most part a little higher, always excepting the American market, which was out of favour. The Money Market is better, and rates are firm. Business in the Gas Market was fairly active in the larger issues, but quiet throughout the rest of the list. In Gaslights, the "A" stock was very quiet at first; and, not meeting with any support, the quotation was put down a couple of points. A rally, however, set in; and the result of it was that, although the quotation was left down, the best price of the week—315½—was marked on the closing day. Business in the secured issues was almost confined to the 10 per cents, which commanded very fair figures; but all the debenture stocks were quoted higher *ex div.* South Metropolitan were quiet, at about middle figures; but the quotation was advanced a point. Commercials were untouched and unchanged. Very little was done in the Suburban and Provincial division; but British rose, and Brentford was strong. Among the Continentals, a great deal was done in Imperial. At first it was very flat, and dropped steadily until on Wednesday it touched 207 for the account. Then there was a sharp rally; and on Saturday it was done once at 219. We believe all this is wild speculation. The solution of the position in Vienna proceeds, and will proceed, very slowly; and nothing certain is yet known. It is not at all improbable that even the wire-pullers there, who loudly proclaim their determination to "drive the proud sons of Albion out of Vienna," have not quite made up their own minds on the subject, and a compromise is possible. European was steady, but Union had a fall. Among the rest, the only thing noticeable was a lot of dealing in Bombay, coupled with a rise. Business in the Water Companies remained restricted. *Ex div.* changes were favourable, especially in the case of Grand Junction.

The daily operations were: Quiet business in all but Imperial (which fell 2) was the rule on the opening day. On Tuesday, transactions were still more limited, even in Imperial, but it receded 2 more. The drop in Imperial proceeded to its lowest point on Wednesday; and the quotation fell 1. Gaslight "A" was sympathetically affected, and moved 2; but British rose ½, and Bombay ¼. Thursday's business was largely in Imperial, which suddenly recovered; and the quotation advanced 3. Union, however, was weaker, and fell 2. Friday was extremely animated; and Gaslight "A" was strongly supported, while the recovery in Imperial was marked by a rise of 5. South Metropolitan advanced 1. Saturday was lively; and prices continued to harden, though quotations did not vary.

ELECTRIC LIGHTING MEMORANDA.

Dispute Respecting the Extension of Electric Traction in Bristol—A Reminder that Municipalized Electricity Supply has Duties as well as Rights.

THERE is a curious sort of quarrel in progress at Bristol between the Corporation and the Tramways Company on a question of electric traction. Bristol has an electric tramway with which the populace are so pleased that the Company working it contemplate an application to Parliament next session for power to extend the system. When the fact of this intention was communicated to the Corporation, a Committee was appointed to consider the matter; and the first thing they did was to consult Mr. W. H. Preece about it. The issue of these counsels was a report recommending that the Corporation should consent to the extension, except in certain parts of the city; but only on condition that the supply of current should be purchased by the Company from the Corporation electric lighting station. Mr. Preece appears to have been at the bottom of this scheme; and he has accordingly come in for some hearty abuse from the leading electrical journals for instigating the Corporation to try and force the Tramways Company to make the electric lighting undertaking pay. Mr. Parshall, also, the Consulting Engineer to the Company, has fallen foul of the Post Office Electrician, and issued a report showing that Mr. Preece has altogether misunderstood and miscalculated the data upon which his recommendation is based. As a matter of fact, to work the Bristol tramways electrically would take about ten times the output of the electric lighting station; and the Company very naturally cannot see why they should be compelled to pay a profit rate to the Corporation on such a supply, instead of doing the work themselves. The idea of getting a sort of day load for an electric lighting station by making it supply power for working a tramway, is a very favourite one with a certain class of electricians, with whom Mr. W. H. Preece must now be numbered. But it is one thing to equalize a station load in this way and another to appropriate a big tramway load to benefit a small lighting undertaking. Our electrical contemporaries point out that there is no reason why a corporation electric lighting venture should be helped out at the expense of the general interests of the community; but the Corporation Committee seem to think that because there is a municipal electricity generating station, all the electricity wanted for power purposes should be bought at this shop.

It is, of course, easy to understand the wrath of the Tramways Company at this arrogant behaviour of the Corporation; but it is somewhat remarkable that the electrical journals should be so strongly moved in regard to the matter. So it is, however; and in their anger they have said some very cutting things about the Bristol electric lighting venture, and Mr. Preece's electrical engineering. They are probably keenly desirous of seeing the electric tramway system extended in Bristol, which will certainly not be done if the Corporation are allowed to have their way. For, though the Corporation view is that their Provisional Order gives them the monopoly of electricity supply in the city, "whether to produce light, heat, motive power, or electric traction"—a claim, by the way, which is inconsistent with the fact that the Tramways Company actually generate the power for all the electric cars at present running—they cannot compel anybody to buy it. Rather than submit to such a domination the Company will continue the use of horse haulage. This is the cause of the wrath of the electrical journals. The "Electrician" admits that a combined tramway and lighting station, when specially laid out for the work—which is not the case in Bristol—is more economical than a lighting station alone; but this is merely because the traction load helps to pay for the lighting load. "But it remains to be proved that such an one can be worked as economically or as cheaply as a large traction station alone;" and until this is proved the Bristol Tramways Company are commended for wishing to keep the generation of power in their own hands, and "refusing to assist the Town Council to make its lighting station pay." The Company, it is pointed out, has been a great financial success; while "the city lighting business, apart from the rental which the city charges itself for public lighting, can hardly be regarded as profitable, as yet." But our contemporary goes on to exclaim in its indignation: "This Bristol episode is an object-lesson in the cant which underlies so much of the frothy verbiage about the blessings and disinterestedness of thorough municipalization. The fact is that whenever a municipal trading venture, be it electric lighting or anything else, has to be helped out of a mess, the general interest of the community is thrust aside, with as little, if not with much less, compunction than would be the case with any limited liability concern. Men are sometimes directors of a joint-stock company, and they sometimes hold the more exalted position of vestrymen. In the one case, when the normal dividend is threatened, and in the other case when a bad deficit has to be covered up, the general weal is pretty sure to be sacrificed. Perish electric traction, rather than that the Electric Lighting Committee of the Bristol Town Council should be debarred from balancing its annual budget at the expense of the Bristol Tramways Company!" This is strong language; and we commend it to the attention of all members of local authorities who may be thinking of undertaking the same responsibilities as those which at present weigh so heavily on the Bristol Corporation.

In connection with the subject of corporation electric lighting responsibilities, the recent experience of the Dublin Corporation is worthy of notice. A business firm having premises in the Dublin compulsory area could not obtain a supply from the Corporation, after prolonged negotiations; and they accordingly sued for the penalty of 40s. a day provided by the Electric Lighting Act to be recoverable from undertakers in default in this regard. When the case went into Court, the Corporation managed to remove the main cause of action by affording the supply of electricity demanded by the plaintiffs, upon the strength of which the Corporation had the effrontery—there is no other word for it—to ask the Magistrate to dismiss the summons and grant them costs, as they had been "most unfairly and improperly put to expense." Fortunately for Dublin, and municipalities generally in the long run, the Court did not take this view of the matter; holding rather that a Corporation was not to be pitied that committed such an unbusinesslike act as keeping a customer waiting more than 300 days for what there was statutory obligation to supply within a reasonable time. The Magistrate would have given damages against the Corporation; but the applicants had not made their demand for a supply of electricity according to the form and in the manner specified in the Provisional Order. In consequence of their failure to comply with the statutory requirements in this respect, plaintiffs were held to be debarred from taking advantage of the provision of the Order with regard to penalties. It was a narrow shave for the Corporation, who could not deny that there had been an application for current which they had recognized by the subsequent negotiations and correspondence. But, undoubtedly, whosoever seeks to put a penal statute in operation must himself have done all that is necessary to satisfy its provisions. The Magistrate marked his sense of the behaviour of the Corporation by refusing to make any order as to costs.

THE PROBLEMS OF POWER TRANSMISSION AND DISTRIBUTION.

In the numbers of the "Engineering Magazine" for September and November, Mr. N. W. Perry published a couple of papers devoted to the consideration of the respective claims of gas and electricity as means of transmitting power to a distance. The articles were, of course, written from an American standpoint; but they contain many observations of general applicability.

The author commences with the case of electricity; and he shows how greatly engineering science has benefited indirectly from the contemporary development of the electrical industries. One illustration of this will suffice, and it lies ready to hand in the steam-engine. Though the making of steam-engines had for many years been the subject of the most enlightened mechanical theory and practice, when the first Edison electric lighting station in Pearl Street, New York, was started in 1881, there was not in the market a steam-engine good enough to meet the requirements of the new service. Now there are many makes of such engines quite competent to satisfy these demands, by which circumstance we can see what the commercial development of electricity supply has done for the steam-engine.

Mr. Perry carries the same line of thought into the realm of abstract engineering science—if there is such a study. He argues that whereas formerly, if civil and mechanical engineers had to deal with the transmission of energy by means of fluids travelling through pipes, they would require to assume as a basis a perfect fluid, and then modify the theoretical results by the use of empirical factors known to be approximately correct only under special conditions, all of which can never be exactly ascertained or fulfilled. Then arises the electrical engineer, who is able to approach a problem of this kind with an assumed perfect fluid at his command. Consequently, he is prone to assume in his work that he has nothing to learn from, and no use for the tentative science of, either the hydraulic or the gas engineer, who have had to learn by experience how to use their own particular medium as they found it. As a matter of fact, however, practical electricians have been constrained to abandon this position of aloofness; and Mr. Perry confesses that "our present methods of electrical distribution are almost exact copies of practice long since recognized by the gas engineer, who, moreover, has solved one problem which we, as electrical engineers, have still to solve—namely, the cheap and efficient storage of our energy." It may be remarked here that the author rather exaggerates the part played by gas engineers in what he calls solving the problem of storing their "energy." It is obvious that there was no discovery or invention in accumulating a store of a ponderable, such as gas, against such time as it might be wanted.

Short of this facility of storage, however, it is true, as Mr. Perry states, that "the virtues and elasticity of the electrical system, and the great simplification which it brings to engineering problems, have blinded its votaries to the virtues of other methods of transmission." To such an extent has this illusion been carried, that engineers of prominence are found to lend their names to assertions that energy can be economically transmitted by electricity under existing conditions "hundreds of miles." We have not seen any of these flights of fancy in connection with any notable names. But doubtless Mr. Perry has; and he is justified in trying to stop them. He lays it down that the distances to which energy may thus be economically transmitted are limited by the original cost of the primal energy, the cost of energy with which it must locally compete after transmission, and the voltage against which it is commercially possible to insulate. The first and second elements remaining the same, the last one must strictly limit the distance.

It is posed as axiomatic that, for purpose of transmission, energy should be in the potential form; while for distribution and subdivision, it should be kinetic. This is proved by the fact that coal can be sent for hundreds or thousands of miles at a cost that still leaves it economical in use; whereas if a potential of 20,000 volts is assumed to be practicable for an electrical transmission system, the electrical energy cannot be so transmitted for economical use at any greater distance than about 30 miles at the outside, in competition with coal transported the same distance.

In low-potential continuous-current lighting systems, the most advantageous arrangement possible at present is the three-wire principle of distribution, with 220 volts between the outside wires. The economical limit of distribution under this system is one mile. Even here it will cost 145 times more to transmit energy electrically than to send it the same distance by rail in the potential form of coal. And this is putting the case unfavourably for the coal used. Contemporary electric lighting practice in the locating of central stations tells the same tale. "Usually, central electrical stations are placed, as the name implies, in localities central to the largest demand for the output; and this more often is on expensive land removed from the railroad. A second charge is, therefore, placed on the fuel by its additional handling and transportation from the railroad or water front to the point of consumption; and this second charge usually exceeds the original charges, even where long rail transportation is involved. As an illustration, the cartage of coal to the Duane Street, New York, Edison illuminating station costs that Company 45 c. per ton above what the fuel would cost were the station located on the water front. Yet it has been found more economical to locate in the centre of their areas of supply, with the expensive ground and water-rents, and these additional burdens on fuel account, than to locate more advantageously in these respects, and incur the increased transmission losses by electricity involved."

The author proceeds to demonstrate that there are other methods of transmitting energy in the potential form, even more economical than that of coal by rail—instancing the distribution of gas and oil in pipes. "Where gas is transmitted for illuminating purposes, it is in one sense a transmission of energy in the kinetic form—just as is our water, if used for turning a water-motor; but if it be transmitted to be burnt in a gas-engine, which in turn is to drive a dynamo for lighting purposes, it forms an illustration again of the distribution of energy in the potential form. By comparing the amounts of light obtainable from a given quantity of gas used in these two ways, we again see the economy of the potential over the kinetic distribution, notwithstanding the numerous transformations involved before the potential energy of our gas takes the form of light." Theoretically three times, practically at least twice, as much light is obtainable from gas used in this way as when directly consumed for lighting purposes by means of ordinary burners.

Returning to the general question, Mr. Perry remarks that for municipalities the problem of the cheap distribution of power is of great and pressing importance, and is now demanding the attention of the best engineering talent in the world. "It is not enough that when the power is delivered it should be cheap, but it is essential that it shall be available—that is, that it shall be in such a shape that it can be utilized with the least inconvenience for the largest variety of purposes." He admits that, when energy is delivered in the electrical power, it satisfies the latter condition more nearly than any other form; but electrical transmission, as distinguished from distribution, is not the best that can be had. If it is, why do not the electric lighting central stations adopt it? Why do they still pay dearly for central positions, coal cartage, and the impossibility of using condensing steam-engines where water must be bought from the town mains, instead of migrating to the water front? The query has every whit as close an application in London and other British cities as it does to New York. The answer is that the change of location would not pay, because the cost of electrical transmission over the additional distance would more than balance the savings effected, large as these would be, by the removal.

The layman might suppose that the electricians are handicapped by the low voltage to which they are restricted; and electricians will say that current can be transmitted at high voltages, and let down for distribution at the central station. Yet, in point of fact, as Mr. Perry observes, this is not done. He means, of course, in the majority of instances; for it is done in some cases, as by the London Electricity Supply Corporation. But the financial success of the proceeding is nowhere very conspicuous.

Hence the author concludes that neither electrical transmission nor the coal-cart is a satisfactory solution of the problem of local transmission—always distinguished from distribution. The electricians put up with the coal-cart rather than adopt the cited alternative—which, be it observed, they are very fond of recommending to other people. But the drawback of coal is that it has to be converted into energy *in situ*. Steam-engines for this purpose are cumbrous, and not capable of continuous use; while the stand-by charges and losses are heavy. Consideration of these sources of expense leads Mr. Perry to the conclusion that "if we could convert our coal into a gaseous fuel at the water front or railroad line, and transmit it in its prepared state to gas-engines located at centres of distribution, we could save half of our floor area, and avoid the stand-by and condensation losses, &c., of our boiler plants, for the stand-by would then be our gas-main, which, if it did not leak, would cause no losses while the engines were idle, and involve no extra expenditure of fuel corresponding to that required in getting up steam and in the drawing of fires."

Mr. Perry refers to the investigations in this field of the late Denny Lane, who proved, as quoted, that "with ordinary town gas of 16-candle power, 3000-horse power could be sent a distance of a mile for an expenditure of 1-horse power—an economy of distribution far exceeding that possessed by any other system, whether hydraulic, pneumatic, or electric, being only 1-30th per cent. of the power conveyed." Carrying this line of argument further, the author deals similarly with the case of the transmission of gas through a 12-inch pipe to a distance of 5000 yards, or nearly three miles. It is assumed that the gas has a specific gravity of ·55, and that 25 cubic feet of it will produce 1-horse power. The results are stated in a table which shows that with a pressure of 10 inches of water, 1600-horse power can so be transmitted by this means for an expenditure of 0·07 per cent. of the total energy. Such a length of cast-iron pipe would weigh about 800 tons, and cost something like £3200. To transmit a similar quantity of power electrically at 10,000 volts, and with the same efficiency, copper wires weighing at least 538,000 lbs. would be required. Charging nothing for insulation, and pricing the copper at 6d. per pound, the line would cost £12,800, or four times the cost of the gas-main. As a matter of fact, the comparative cost would be higher, because transformer

losses would have to be provided for in the case of electricity. Hence Mr. Perry concludes that "it is not theoretically possible to transmit energy electrically in municipalities so efficiently or so cheaply as it is actually accomplished to-day by gas." This statement, however, applies only to comparatively short distances. When the distance is protracted, a point is reached at which the efficiency curves of the two systems of transmission cross.

The next question for consideration is how far gas transmission can go in competition with the coal-cart. Mr. Perry finds that, for the 5000 yards in question, the gas transmission is the cheaper, even if a gas company's profit is thrown in. Besides all this, moreover, the gas manufacturer has in his cheap and efficient method of storage an immense advantage not enjoyed by the steam or electricity producer. This enables gas manufacturing plant to be operated continuously at nearly maximum efficiency, which means huge and various savings impossible to the steam engineer and the electrician. The gas-light load and that of the electric light are very nearly the same; and the maximum load of each is seldom less than two-and-a-half times the mean load. "The gas engineer's method of storage, which does not involve any appreciable loss in energy, and permits him to draw upon it at any rate desirable with equal economy, costs very little per unit of capacity, and decreases in cost very rapidly with increase of capacity." Mr. Perry works it out to about $1·50 per horse-power-hour capacity in the case of gas-holders equal to 3 million cubic feet and upwards. "The electrical engineer, on the other hand, in order to store his energy, must mean by that step a loss of not less than 20 per cent. of the energy stored, and must pay for his storage battery at the rate of $30 per horse-power-hour, whether the capacity be large or small. The cost of maintenance and labour to keep the storage plant in effective condition is large, and the rate at which he may draw on his supply limited."

The author now returns to the subject of distribution, and claims that if the electrical engineer cannot transmit his power as economically as can the gas engineer, he can distribute it in a form far more generally available; and he accordingly suggests that the best results will be obtained, where comparatively short transmissions are concerned, by taking advantage of the economies of gas transmission and then distributing electrically over short radii—far shorter than are now usually supplied. This indicates a combination of gas generation, storage, and transmission with electricity generating stations actuated by gas power. This is something like the Belfast plan, which Mr. Perry accordingly describes. He does not, however, indicate that he is acquainted with the actual condition of this experiment in electric lighting by gas power. He considers the advantages of Dowson gas; but—unlike so many of those who write upon this subject—he is fully aware of the drawbacks of this class of gaseous fuel when it is a question of transmission to a distance. Consequently, he is led to admit that, "in transmitting a poor and heavy gas, the expense is increased in a large ratio; and it remains to be determined in each particular case whether the greater economy of transmission, and of gas-engine and storage capacity, involved in the use of a rich gas, does or does not counterbalance its greater first cost." This is a very proper way to state the question; and it is the only way that can possibly lead to a practical solution of the main problem. After all, Mr. Perry appears constrained to believe that "there is so wide a margin between the cost and efficiency of transmission for short distances of power in the form of gas over the coal-cart or the electrical means, that it seems that, for transmission within municipalities, the gas-pipe has the lead."

The question of electrical traction for city railways hangs by the same thread; because at present the steam locomotive can carry its energy in the form of coal more cheaply than the electrician can transmit it. Mr. Perry is inclined to believe that "if gas of a suitable quality were generated on the water front and conveyed in pipes to gas-engines located at frequent intervals along the route, and the energy distributed thence electrically, the electric motor would be found both cheaper and more convenient than steam."

This is as may be. It is entirely correct to say, however, that Mr. Perry has in this essay defined the manner in which the problem of cheap power generation and transmission must be attacked, if it is to be solved successfully with regard to any particular application. There is no general solution to be hoped for. The special local conditions must be ascertained and appraised by an expert in every instance before it can be determined whether steam or gas power be the cheaper; and if the latter, what sort of gas is to be preferred. Before the way is thrown open for gas power, moreover, it will be necessary to make sure that this can be had in units suitable to the requirements. At Belfast, as we understand the local circumstances, the gas power stations have had to be supplemented by steam; and so long as this is an eventuality, it is useless to pretend that gas power is competent to provide all the electrical service demanded by a large community. Short of this completeness, it is indisputable that gas power could do much more in this way everywhere than it has hitherto been called upon to perform.

Gas-Engines in Central Europe.—The number of gas-engines now in use in Central Europe is stated to be 15,644; representing an aggregate of 52,694-horse power.

OBITUARY.

Mr. JOHN WEIR, for many years the Senior Superintendent of the Metropolitan Gas Company of Melbourne, Victoria, died on the 9th ult., in his 77th year.

The death took place on the 7th inst., after a short illness, of Mr. EPHRAIM RANDELL, who was for some years the Manager of the Cromer Gas Company. On resigning this position, he became a Director. Deceased was in his 77th year.

We regret to learn, from technical American contemporaries which reached us on Saturday, of the death, on the 28th ult., at his residence, Glen Ridge, New Jersey, of Mr. JOSEPH R. THOMAS, the Editor of the "American Gaslight Journal." Deceased was well known in America as a gas engineer; and for many years he had charge of the Williamsburg works. We shall doubtless be able, when the next number of the above-named publication comes to hand, to give some particulars in regard to Mr. Thomas's life-work, which was brought to a close by heart disease.

PERSONAL.

Mr. G. SPURGEN has been elected Chairman of the Folkestone Water Company, in succession to the late Mr. J. Sherwood.

The salary of Mr. J. GOODWIN, the Secretary of the Grand Junction Water Company, has been increased by £100 a year.

Mr. FRANK ROBERTS has been elected Borough Surveyor of Worthing. As the new water-works for the town are approaching completion, a large portion of Mr. Roberts's time and ability will be devoted to matters connected with water supply.

Mr. F. NIVEN, son of Mr. G. H. Niven, of Cleckheaton, has obtained the appointment of foreman at the Buxton Gas-Works, for which applications were invited in the "JOURNAL" for the 17th ult. The successful candidate is at present with Mr. R. G. Shadbolt, at Grantham.

Mr. J. BUDD, on leaving Gravesend, where he has been Assistant Borough Surveyor, to take up his new duties as Surveyor and Water Engineer at Leominster, was presented with an illuminated and framed address, and a purse of gold subscribed for by 200 friends resident in the first-named town.

Mr. F. BATHURST, Assoc.Inst.E.E., has been awarded by the Council of the Society of Arts the Fothergill prize of £25 and a silver medal for a paper on "The Best Means of Effectually Preventing Leakage of Current to Earth in Electrical Installations from Generating Heat and Setting Buildings on Fire."

The Supply of Electricity in England and America.—Mr. R. Hammond, the Consulting Electrical Engineer to the Hull Town Council, has presented to the Council some statistics regarding electricity supply works in this country operating under statutory powers. There are 115 in all—68 being in the hands of local authorities, and 47 in those of companies. The capitals are £3,150,000 and £5,650,000 respectively. According to a paper contributed to the "Electrical Engineer" by Lieut. B. A. Fiske, of the United States Navy, the capital invested in the various electrical arts in America amounts to no less than $1,500,000,000.

Proposed Reorganization of the Local Government Board.—According to the "Local Government Journal," a Treasury Committee has been appointed to inquire into the working of the Local Government Board, with a view to reorganizing the department. The present methods of the department have for some years been the subject of complaints at the meetings of public bodies, in the newspapers, and even in the House of Commons; and recently the Association of Municipal Corporations sent a deputation to Mr. Chaplin to represent to him the inconvenience caused in the large towns where important works have to be held back for want of the official sanction to loans. The Committee will probably consist of several officials of high standing at the Treasury, and Mr. T. W. Russell, M.P., representing the Local Government Board.

The Transactions of the Incorporated Gas Institute.—We have received the volume of Transactions of The Gas Institute for the current year. It contains a report of the proceedings at the thirty-third annual meeting, held at the Society of Arts in June, under the presidency of Mr. W. R. Chester, M.Inst.C.E.; also the lists of officers and members, and the other matter which usually supplements the record of the technical work of the Institute, including the useful subject-matter index. The papers read at the meeting were noticed in the "JOURNAL" at the time of their publication in the course of the report; and we need only now say that, where practicable, their value, as contributions to the literature of the gas industry, has been enhanced by additional illustrations in the text and by folding plates. The papers of Mr. E. Lloyd Pease and Mr. W. Sugg are examples of this; while the interesting communication by Mr. Dougall, on "The Popularization of Gas," is accompanied by some specimen pages of the prepayment meter account-books used by the Tunbridge Wells Gas Company. These will be found useful by those members of the Institute who are introducing the new system of gas supply. It only remains to say that the volume has been produced under the editorship of the Secretary (Mr. Walter T. Dunn), who must be complimented on its general appearance.

NOTES.

Can Calcium Carbide be Profitably Produced by Steam Power?

The "Zeitschrift für Beleuchtungswesen" gives the substance of a discussion of this question by Herr Armin Tenner, of Schöneberg, near Berlin. Calcium carbide is at the present time almost wholly produced by water power; but it has been recently made at Seuftenberg, in Germany, with brown coal. The present production falls far short of the demand. Freight is high, and water power scarce, in Germany; and hence this inquiry is of much relevance there. It is evident that steam power could only be profitably applied in places where fuel is cheap, and lime and coke can be readily obtained. Such spots are to be found in Silesia. For calculating the cost of calcium carbide by steam power, the amounts of coke and lime which past experience shows are consumed in the electric furnace have been taken, and a large installation has been assumed, as small ones are unremunerating even when water power is used. The present value of carbide is about £22 10s. per ton; but the price kept in view has been £15, which would enable acetylene to be produced more cheaply than most of the lighting agents at present in the field. It may be expected that, in course of time, the loss of the raw materials and the consumption of electrodes will be much reduced. A plant of 2200-horse power, estimated to give a daily production of 7¼ tons of carbide, would require a sum of nearly £61,500 for the steam and electrical installations, and for working capital. Coal for fuel is taken at 2s. 6d. per ton; wages, at £6430 per annum; coke, at 10s. per ton; and lime, at the same figure. After providing for interest on capital, depreciation of plant, and small items of expenditure, the yearly profit, provided the price of £15 per ton of carbide is realized, is calculated to be about £8725. The profit would be extinguished by a fall in price to about £11 per ton.

The Limits of Electric Power Transmission.

Dr. Louis Duncan, the President of the American Institute of Electrical Engineers, devoted his Inaugural Address this year to the subject of the distribution and transmission of electrical energy. He said there have been great advances of late years in the transmission of electrical energy, mainly through the introduction of multiphase alternating currents. Single-phase alternating currents permit the transmission of power to long distances, and its distribution for lighting purposes. It is also possible to supply power from such circuits to large motors working under a steady load. It is not possible, however, to distribute power in this way economically for ordinary uses. The introduction of multiphase alternating systems, when two or three alternating currents differing in phase are employed, has completely changed the situation with respect to long-distance transmission. The first plant suitable for transmission to a distance was on the continuous-current system; and even now this is being extended, and works well for sending a few hundred horse power to a distance of 15 miles. Looking broadly at the value of multiphase alternating transmission, as against continuous-current transmission, the former shows a gain in simplicity and safety. A number of calculations have been made as to the possibility of transmitting electrical energy to long distances; and Dr. Duncan, while deprecating too great a play of the technical imagination round this question, admits that the limit of distance and potential has not been reached. Upon established facts, it may be said that 20,000 volts could be employed in a transmission to 50 miles, if the energy could be provided at such a price as to be considerably cheaper than energy locally generated from steam plant. Everything beyond this is experimental.

The Standard of Lighting for Reading.

The subject of illumination is discussed, in connection with the use of the eyes for reading, in a paper contributed by Mr. Harold Griffing and Mr. S. J. Franz, in the "Physiological Review." The authors observe that the increased part played by reading in the life of civilized man has resulted in the wide prevalence of myopia, astigmatism, and kindred disorders of the visual organs. Myopia would be rare if the eyes were never fatigued; and the authors address themselves to the elucidation of the physical conditions of fatigue in reading, and the best means of avoiding it. From their experience, they conclude that the size of type is the all-important condition of visual fatigue in reading. They conclude that no type less than 1·5 millimetres in height should be used; the fatigue increasing rapidly even before the size becomes as small as this. This, it may be remarked, corresponds nearly with the type known in English as "Long Primer," which is used for the editorial columns of the "JOURNAL." The intensity of the illumination of the printed page is apparently of little consequence within the ordinary range of daylight in well-lighted rooms. Very low intensities, less than from 3 to 10 candle-metres, are sources of even greater fatigue than small type; and 100 candle-metres may be considered a safe limit. White rather than yellow light should be used for artificial illumination; and white paper is to be preferred, though it is possible that the greater amount of light reflected from pure white paper may cause some fatigue. The form of type is of less importance than the thickness of the letters; and additional "leading," or spacing, should be provided between the lines.

TECHNICAL RECORD.

DOMESTIC ILLUMINATION BY MEANS OF GAS.

By VIVIAN B. LEWES, F.I.C., F.C.S.,
Chief Gas Examiner to the Corporation of the City of London, Professor of Chemistry at the Royal Naval College, Greenwich.

[The Last of a Course of Cantor Lectures at the Society of Arts, delivered Dec. 7, 1896.]

Though coal gas is by far the best illuminant that can be employed, there are many villages and small towns still existing where the limited consumption would render gas-works commercially impossible, and where, therefore, the oil-lamp and candle still reign as the chief methods of obtaining light. Under these circumstances, also in country houses and institutions, such as workhouses, hospitals, infirmaries, &c., gas made from substances other than coal is frequently employed.

The great class of bodies which we call hydrocarbons, and which include all the waxes, fats, and oils, and many gaseous compounds, have been shown by experiment to be simplified in their composition by the action of heat. The more complex ones, in which many atoms are packed away in a molecule, have, as a rule, the solid form, such as a wax or fat. On heating, these complex bodies break up, and become simplified in form; and among the less complex the liquid hydrocarbons play an important part. These again become further simplified by the action of a higher temperature or more prolonged heating, until the simplest or gaseous hydrocarbons are obtained; while these latter can again be broken up into their constituents —carbon and hydrogen. It is therefore manifest that, given a solid or liquid compound of carbon and hydrogen, these may be converted into gaseous matter with much the same characteristics as are to be found in coal gas; and oil gas made by the breaking up of various grades of oil has been in use for as long a period as coal gas itself.

Many forms of apparatus have been devised for the production of this gas; but most of them only differ from each other in the general arrangement of the apparatus, and not in any specific principle. Of these oil-gas processes, those which have received the most general support have been the Pintsch, Pope, and Patterson, the chief differences between which are in the shape of the retort and the method of introducing the oil into it; and all such methods of decomposition give liquid and solid residuals as well as the oil gas.

The Patterson plant consists of a horizontal retort of cylindrical form built into a furnace, containing an oven or flue space in which the retort is placed. The oil to be converted into gas is led from the oil-tank into the retort by two straight horizontal pipes extending from the front nearly to the back of the retort; the inner or back ends of these pipes being open. The supply of oil is partly converted into vapour while passing along these pipes; and on issuing from the ends, it is further decomposed by the heat in its passage from the back to the front of the retort, where the outlet is situated. The main supply of oil is regulated by a stopcock; while another tap on each retort-pipe controls the supply to the retorts. The gas passes from the retorts into an atmospheric condenser, and then into the holder. The arrangements of the apparatus allow of the action being easily and satisfactorily regulated and controlled.

The manufacture of an oil gas in any such apparatus requires care in the selection of the material to be decomposed. The essential points which govern the selection are, first of all, the cost of the crude material, and secondly the ease of working. A long series of experiments made by me to ascertain which is the best hydrocarbon to employ and the best temperature at which to work, gave 900° C. as that at which the best results are obtained, and that the oils most suitable for use are the Russian "Solar distillate," obtained by further distillation of the residue of Russian Baku oils after the lighter kerosenes have been driven off. Nearly as good are the blue and green shale oils. Working with these oils at a temperature of 900° C., the best results obtainable per gallon would be 98 cubic feet of 50-candle gas, which would be equal to 980 candles per gallon of oil. In each case there would be about 20 per cent. of the volume of the original oil condensed as residuals; these latter containing a certain amount of benzine as well as paraffins and olefines of low boiling points, but of very little use for re-cracking.

From time to time attempts have been made to manufacture an oil gas so that there shall be no liquid residues, and that the whole of the oil shall be converted into gas or left as a solid residue in the retorts. The first process of this kind was one introduced in 1846 by Hilary, who placed tube condensers above his oil-retorts, so that all the liquid condensed ran back into the retorts, and became further carbonized—his ultimate products being nothing but coke and gas. This idea has been further improved by Mr. W. Young, whose method of retorting oil in such a way as to yield nothing but coke and gas has achieved a great success, and plays a very important part in the methods of enriching poor coal gas now largely adopted in the North of England and Scotland, in which oil gas takes the place of cannel in bringing up a 15-candle coal gas to the absurd standard which public opinion there seems to think necessary. Young's process for the manufacture of oil gas from the Scotch shale oils is

entirely dependent upon the principle of washing the oil gas, retorted at a moderate temperature, by means of the oil which is afterwards to undergo decomposition—a process which frees it from all condensable vapours, and allows only permanent gases to escape to the purifiers. There is no doubt that, in doing this, very considerable quantities of the olefines and other fixed gases are also absorbed; but as these are driven out again by the action of the heat in retorting, no loss takes place. [The lecturer described the plant and process.]

The gas obtained by this process when consumed *per se* in the burners most suited for its consumption, gives in the photometer an illuminating value of 50 to 60 candles; but the enriching value is said to be considerably above this. The reason for this phenomenon is that the duty obtainable from any burner is entirely dependent upon the regulation of the size of the flame so that the gases, as they burn, shall get a proper proportion of oxygen within a reasonable distance of the nozzle of the burner, and also upon the temperature of the flame itself. From this it will be seen that a gas of a certain illuminating power will give varying results according to the burners in which it is consumed; the burner suited for a poor coal gas being utterly unfitted for a rich gas—a point which is too often overlooked, not only in testing the illuminating value of gases, but also in their practical consumption. A 16-candle gas requires a very large burner in order that the best results may be obtained from it as a flat flame. But the size of the burner has to be rapidly decreased as the proportion of heavy hydrocarbons in the gas increases, as sufficient air must be supplied to the flame to enable it to burn without smoking. The smaller the flame, the greater will be the cooling action of the nitrogen of the air, and also of the burner. The result is a burner has to be selected for each gas of such size that the gas will burn just without smoking.

If an oil gas, for instance, be taken, which is capable of emitting an illuminating value of 50 candles per 5 cubic feet, it will be found that a No. 2 Bray burner will give a heavy smoky flame; and this would be worse as the size of the burner increases. But if a No. 0 Bray were employed, a smokeless flame would be the result; and this burner would give an illuminating value slightly under 50 candles per 5 cubic feet of gas consumed. If the size of the burner be now decreased, the illuminating power recorded will also decrease, until with a No. 000 Bray the gas would only have an illuminating power of 35 candles per 5 cubic feet; this falling off being entirely due to the cooling of the flame. Manifestly, therefore, with such a gas, the No. 0 burner would be the best to employ in order to get the highest results from it. With 60-candle gas, it is impossible to get a burner which will develop the maximum illuminating power, as the cooling action destroys a large percentage of the value of the gas; the burner having to be so small in order to yield a flame which shall not smoke. For this reason, it often happens that the enriching value of an oil gas is higher than would be expected from the results obtained when the gas is burnt by itself in the photometer.

The differences which exist in chemical composition between oil gas made by the various processes is, after all, but slight. The Young process, however, owing to the slightly lower temperature which is employed, gives a gas which is richer in unsaturated hydrocarbons—*i.e.*, hydrocarbons which have the greatest power of illumination during combustion, and which consist chiefly of ethylene and butylene; the average of many analyses of gases being comprised in the following table:—

	Young.	Patterson.	Pintsch.
Unsaturated hydrocarbons	43·83	33·16	35·65
Saturated hydrocarbons	36·30	45·15	45·37
Hydrogen	16·85	19·65	12·44
Carbon dioxide	0·63	0·50	0·74
Carbon monoxide	0·00	0·50	0·60
Oxygen	1·14	0·60	2·00
Nitrogen	1·25	0·44	3·20
	100·00	100·00	100·00

For domestic illumination, oil gas has many drawbacks. In the first place, the apparatus which has to be employed for its manufacture is almost as bulky as a small coal gas installation, and necessitates scrubbers of much the same character; and keeping the furnace heats constant for raising the temperature of the retorts requires most careful attention, as otherwise stopped ascension-pipes and burnt retorts constitute a very serious cause of delay and expense. In the consumption of the gas, moreover, the burners employed have to be so small as to seriously detract from the illuminating value of the gas; and its tendency to smoke when any considerable variation in its richness in hydrocarbons takes place, is anything but an endearing quality to the country householder.

At the present time, the introduction of acetylene gas, made by acting upon calcic carbide with water, which is at once the most easily made and the most brilliant illuminant of all known gases, promises a complete revolution in domestic lighting where coal gas is not to be obtained. But much has yet to be done in educating the public as to the proper way in which to use it, and also in the character of the carbide from which it is produced, and in the forms of apparatus used to generate the gas. Acetylene (or, as it is sometimes scientifically called, ethine) is a gaseous compound of 24 parts by weight of carbon with 2 parts of hydrogen; and it was first discovered and isolated by Edmund Davy in 1836. It was not until 1859, however, that Berthelot's investigations gave the scientific world a clear conception of its interesting character and properties. Since that time, it has been frequently prepared in small quantities by tedious and costly processes. It is only within the last few years that a cheap and simple method has been discovered, and has brought its use within the range of commercial possibility.

The fact that carbon and lime could be made to directly act upon each to form calcic carbide was discovered independently by Willson in America and in France by M. Moissan. But there exists abundant proof that Willson was making and experimenting with calcic carbide, and had sent specimens of it to various correspondents, some time before Moissan had made any announcement of his discovery; and therefore priority undoubtedly rests with the American discoverer. Calcic carbide is a dark grey substance, having a specific gravity of 2·262, and, when pure, 1 lb. of it will yield on decomposition 5·8 cubic feet of acetylene. Unless, however, it is quite fresh, or means have been taken to carefully protect it from air, the outer surface becomes slightly acted upon by atmospheric moisture; so that in practice the yield would not exceed 5 cubic feet. The density and hardness of the mass protect it to a great extent from atmospheric action; so that in lumps it does not deteriorate so fast as would be expected. In the powdered condition, however, it is quickly decomposed. On the addition of water to the calcic carbide, a double decomposition takes place—the oxygen of the water combining with the calcium, and once again forming lime; while the hydrogen unites with the carbon of the carbide to form acetylene.

At the present moment, the future of acetylene as an illuminant is largely dependent upon two factors—first, the commercial production of calcic carbide of a reasonable degree of purity; and, secondly, methods for safely making and burning the gas in such a way as to develop its full illuminating power while doing away with the risk of smoking. As I first drew attention to the production of the carbide, and from it of the acetylene, on a commercial scale in this country,* I feel that the results of the past two years' experience will not be without interest.

In spite of extended experience, both in England and abroad, in the manufacture of calcic carbide, the details given as to its cost and the price at which it can be purchased offer the most entertaining reading, as, while the patentee and would-be seller of acetylene-generating plant still talk airily of the cost of the carbide being anything from 30s. to £7 a ton, the price at which one can purchase it nearly approaches £30. Indeed, in Paris, at the present time, there is considerable difficulty in getting it at £40 a ton; though we are informed that this is merely due to a temporary carbide famine, and that the new sources of supply will soon reduce the selling price even below £16 a ton, at which it stood before the late rise. Be this as it may, the factor which interests us is the price at which carbide can be obtained in England. The Acetylene Illuminating Company, who hold the Willson patents for the production of carbide, and also the Cowles electric furnace patents, which I believe enable them to control the manufacture of carbide in this country, have fixed their selling price at £28 per ton; and though there is no doubt that they will make contracts in considerable quantities at a reduction on this price, yet it is with the factor of the selling price to the public, and not the manufacturing price, that we have to deal.

In most cases, the possible prices quoted for calcic carbide by inventors who have been carried away by their wishes rather than by hard facts, are simply absurd, and far below the price at which the substance can be produced; and it may be of interest if I give the figures for the electric power necessary, which I myself have obtained in practice in the manufacture of calcic carbide. Having been kindly granted the use of the electric plant erected for the manufacture of calcic carbide at the experimental works of the Acetylene Illuminating Company—a plant capable of working continuously at from 60 to 70 volts at 1000 to 1200 ampères—I made a series of experiments in order to determine the best proportions in which to take the ingredients from which carbide is manufactured, and find out the material made per electric horse power.

The production of carbide from lime and carbon under the influence of the heat of the electric furnace appears to take place according to the formula—

$$CaO + C_3 = CaC_2 + CO;$$

and in order to obtain this reaction, it would be necessary to use 56·1 per cent. of lime mixed with 43·9 per cent. of carbon. In practice, however, it must be remembered that the carbon used will either be finely-powdered coke, or charcoal, neither of which is pure carbon; while the lime employed will always vary in purity—such variations having, as I shall presently show, a very important bearing upon the purity of the carbide and acetylene produced from it. Another practical point also presents itself—viz., that, unless the mixture is suitably arranged, considerable variations in the amperage, and consequent loss of efficiency in the furnace, will result.

Using a mixture of 60 per cent. of lime and 40 per cent. of carbon, a run lasting 3½ hours yields about 112 lbs. of fused ingot; and of this 81 per cent. was practically pure carbide—the remainder being a crust of lower value. The mixed carbides yielded 5 cubic feet of gas per pound, and contained 89·2 per

* See paper read at the Society of Arts, Jan. 16, 1895—"JOURNAL," Vol. LXV., p. 168.

cent. of true carbide; hence the yield of the commercial carbide may be taken as being 32 lbs. per hour. The current used was 60 volts at 1000 ampères, or 80 electric horse power, which gives as the make about 0·4 lb. per electric horse power per hour. The result of continued experiments shows that 0·3 to 0·4 lb. per electric horse power per hour is the average yield.

The cost of the electric horse power will, of course, vary with the source from which it is obtained; and the use of steam power for generating the electricity appears too costly to be entertained, unless the present electric lighting stations could see that it was to their advantage to level up their load by manufacturing the carbide under licence when not employed in supplying current directly for illuminating purposes. The Acetylene Illuminating Company have, however, secured considerable water power at the Falls of Foyers, and a full installation of carbide plant is now at work there; while still further water power has been secured in a convenient position, and additional works will be erected. But it will always be the demand for, and not the cost of, the carbide which will govern the price.

The following yields of acetylene from various samples of commercial carbide that I have analyzed give an idea of the variations to be found in the article:—

Swiss carbide per pound	I.	yielded	4·38	c. ft. of acetylene.	
	II.	„	4·60	„	„
	III.	„	4·56	„	„
German carbide „	I.	„	3·82	„	„
	II.	„	3·46	„	„
	III.	„	3·24	„	„
	IV.	„	2·43	„	„
English carbide „	I.	„	5·24	„	„
	II.	„	4 84	„	„
	III.	„	5·04	„	„
	IV.	„	5·52	„	„
	V.	„	4·84	„	„
	VI.	„	5·32	„	„

It is evident, therefore, that there are wide differences in the commercial article; but with reasonable care in the manufacture, the carbide should yield an average of 5 cubic feet of acetylene per pound.

The gas obtained from the English carbide is very pure; the chief impurity being 2 to 3 per cent. of sulphuretted hydrogen, due to sulphur in the coke and gypsum in the lime; while with many of the Continental samples, 6 to 9 per cent. of impurities is by no means uncommon. One of the principal and most dangerous impurities is phosphoretted hydrogen, which is evidently due to the use of phosphatic lime in the manufacture of the carbide; and also traces of siliciuretted hydrogen. So bad is this with some samples, that the acetylene produced from one batch obtained from Denmark actually gave a haze when burnt for some time in a small room.

It is manifest that, if the carbide is contaminated with calcic phosphide, the action of water upon it must give rise to a certain quantity of spontaneously inflammable liquid phosphoretted hydrogen, as well as the gaseous compound; and the liquid condensing during compression or in the storage holder is a very grave source of danger. In the manufacture of carbide, no lime or coke should be used which contains more than the smallest trace of phosphates. If this point is not more carefully attended to than it is at present in some of the Continental works, serious accidents are sure to follow; while if this is done, as is the case in the manufacture of English carbide, no danger from this cause need be apprehended.

Ammonia is also found as a frequent impurity in acetylene and gives it the power of attacking copper, with the formation of an explosive compound.

In the paper I read before the Society of Arts in January, 1895, I pointed out the ease with which the acetylene was liberated from the carbide by the action of water; and I suggested several forms of apparatus in which such decompositions might be brought about. These suggestions were followed by a rush of would-be inventors into the patent office, the literature of which has been increased to an alarming extent during the past two years by patents, many of which are characterized neither by novelty nor utility, and which, moreover, are in cases fraught with considerable danger. With the further experience which I have gained in the production and properties of this gas, I now see that many of the hints which I threw out in that paper as to the construction of apparatus, would be fraught with many drawbacks, as though most of the dangers with which acetylene was then credited have disappeared into thin air, some other totally unexpected ones have taken their place; and most manufacturers of acetylene apparatus being still ignorant of them, a lively time may be expected for those who employ appliances constructed by people possessing a limited mechanical knowledge, and knowing absolutely nothing of the properties of the gas with which they are dealing. These are certain to give rise to many troubles in use, and so to retard the utilization of this beautiful illuminant.

In the generation of acetylene from calcic carbide, far too little attention is being paid to the high temperature evolved when any considerable quantity of it is brought into contact with water, and the effect which this has upon the gas. Several attempts are being made to introduce automatic machines for the generation of acetylene, on the principle of the ordinary Kipps sulphuretted hydrogen apparatus. Indeed, several of them are only modified copies of this in metal. The idea of the manufacturers is evidently that the action will cease and the evolution of acetylene be stopped when the pressure of the gas drives the water back from the carbide. But this is not so, as the heat of the action saturates with water vapour the gas present; and as the apparatus cools, this re-condenses on the carbide, and produces more gas, while the unchanged carbide will decompose the vapour before condensation, and even dehydrate the calcic hydrate which was formed on its surface when the water was in contact with it. The result of this is that, after the gas has once been made, no automatic arrangement will stop the slow generation of the gas from the carbide in the apparatus. When the gas is being continually used, this does not matter much, as the slowing down of the evolution of the gas is sufficient to allow the consumption to catch up the make, But when the gas is turned off, if any quantity of carbide is undecomposed, the automatic generator, with its small holder, becomes an active danger, as it will either "blow" or generate dangerously high pressures.

In any form of generator where the quantity of carbide is large, the heat produced by the action of the water on the material is quite sufficient to polymerize some of the acetylene into tar-like products, which will sometimes cause trouble, and stoppages in the pipes. In any case, the high temperature causes a large amount of steam to go forward with the gas; and unless special precautions—such as using a sufficiently large holder—are taken to prevent it, some of this is carried forward to the service-pipes. There is no doubt that, for the use of the gas in country houses, a holder large enough for an evening's supply should be provided; and the generators ought not to be charged with more carbide than is necessary to yield a volume of gas equal to the capacity of the holder.

The dangers of acetylene, of which a good deal has been heard lately, are almost entirely dependent upon the use of impure carbide and improper apparatus. Pure acetylene has now been shown to be less poisonous that ordinary coal gas, and far less so than coal gas enriched with carburetted water gas; while the action of the pure dry gas on metals is practically *nil*. It is well known that acetylene can be resolved into its constituents by detonation; and the idea has arisen from this fact that acetylene is itself an explosive of great power. This is, however, an error, as it has been clearly shown that, when the gas is under ordinary atmospheric pressure, if detonation is started by a charge of mercuric fulminate, the explosion only extends a few inches from the detonator; while the explosion in acetylene of acetylide of copper is insufficient to set up detonation of the gas under these conditions. This, however, only applies to acetylene under ordinary pressure; and any attempts to liquefy it by the pressure created by the evolution of the gas from calcic carbide is an extremely dangerous operation, as, if the heat of generation is added to the heat evolved during compression, an action akin to detonation is very likely to take place with the resolution of the acetylene into carbon and hydrogen. Out of the many forms of generator which have been patented in this country and abroad, there are some which, though there is no very startling novelty in their construction, afford safety in use; and intending users of acetylene apparatus should make sure that the generators they employ have been examined and certified as safe by some competent authority.

I have pointed out some of the troubles existing in the production of acetylene on a commercial scale; but, given a good form of generator, the trouble which still exists is that there are but few burners at present manufactured which can be relied upon to consume it in such a way as to develop from it its wonderful illuminating power for any great length of time without smoking; and when the burner itself starts smoking, it can easily be realized that its business capabilities are immense. For domestic illumination, a burner consuming more than one cubic foot of the gas per hour would have too intense a light to be practically usable; and I have found it possible to make a burner which for this consumption shall emit a light of from 32 to 34 candles, which is ahead of the duty obtained for the same consumption by any other burners I have tested. But with all burners, good and bad alike, after a certain period of perfect burning, which may extend to several hundred hours, a time is sure to arrive when the burner commences to smoke; and, as a rule, all that can be done with it is to take it out, and put in a fresh one. The cause of this is that, in all burners fitted for the consumption of acetylene, the holes or slits through which the gas issues have to be exceedingly fine; and, in time, the heat of the burner causes the polymerization of some of the acetylene into liquid hydrocarbons, which, being decomposed in the hole or slit, give rise to a slight carbonaceous deposit and the growth of carbon filaments from the exit. These filaments can be easily removed when they make their appearance; but the partial stoppage in the fine aperture of the burner itself upsets the balance of the burner, and causes smoking. The fact that burners can be cheaply obtained which, for a limited time, give satisfactory results, enables dealers to sell burners, and to declare that no such trouble exists. But the public who are induced to buy will soon discover the facts for themselves.

Acetylene is soluble in water and many other liquids. At ordinary temperature and pressure, 10 volumes of water will absorb 11 volumes of the gas; but unless the gas is bubbled through the water, the absorption is hardly noticeable in the case of an ordinary receiver or gasholder, as the surface of the water rapidly becomes saturated. After that the absorption is very

slow; while when the whole bulk of water is completely saturated, the absorption stops. The solubility of the gas may also be largely done away with by dissolving salt in the water surrounding the holder. This, however, has a destructive action on the metal; and it is therefore better to use ordinary water as the liquid over which the gas is collected and stored.

The gas can be condensed to a liquid under a pressure of 21·53 atmospheres, or 323 lbs., at a temperature of 0° C.; while at ordinary temperatures the pressure necessary to keep it in the liquid state is from 500 to 600 lbs. on the square inch. The liquefied gas can therefore be readily stored and transported in steel cylinders of the kind employed for liquid carbon dioxide. The liquid so produced is mobile, and highly refractory; and when sprayed into air, the conversion of the liquid into the gaseous condition absorbs so much heat that some of the escaping liquid is changed into a snow-like solid, which takes fire on applying a light to it, and burns until the solid is all converted into gas and consumed. The possibility of liquefying acetylene at pressures about those at which liquid carbon dioxide is produced so largely, enables enormous volumes of gas to be compressed into the liquid state in small wrought-iron or steel cylinders; and in this condition, by means of suitable reducing-valves and burners of the right construction, it may be stored and burnt. The small cylinders can also be arranged in the form of portable lamps; while for use in the country, where no gas is available, a large cylinder of the liquid gas placed in an outhouse would supply a country house with light for a very long period.

It is now well recognized that all luminous hydrocarbon flames owe their light-giving properties to fine particles of carbon liberated within the flame by various processes of decomposition, and raised to incandescence partly by the heat of the flame, and partly by the heat generated by the same actions which caused the separation of the carbon; and it is to the formation of small traces of acetylene in all hydrocarbon flames that a large amount of their luminosity is due. We should therefore expect that acetylene, when burnt by itself, would be the most brilliant of all gaseous illuminants—an expectation which is fully borne out by the results in practice. Acetylene gas when burnt gives a flame of intense brilliancy; and, owing to its richness, it can only be consumed in small burners. Under these conditions, it emits a light greater than that given by any other known gas; its illuminating value, properly developed, calculated to a consumption of 5 cubic feet an hour—the average consumption of ordinary coal gas—being no than less 240 candles. It is thus seen that when acetylene is employed in suitable burners, it develops an illuminating value 15 to 20 times greater than that obtained by the combustion of the same volume of coal gas. So that, for all practical illuminating purposes, a very small consumption of acetylene in the burners which practice has shown to be best suited for the purposes, does the illuminating work of a very large volume of coal gas, with the result that the air of the room is but little contaminated with products of combustion, and the excessive heating of the upper portions of the air is reduced to a minimum.

The following table contrasts the products of combustion evolved from London coal gas when consumed in various forms of burners, and furnishing an illumination of 48 candles, which may be presumed to be the quantity of light required in a fair-sized London dining-room. Contrasted with this is the amount of the products of combustion which acetylene would evolve in giving the same amount of light; while, to make the meaning clearer, I have added the number of adults who would exhale an equal amount of carbon dioxide in the same time:—

Burner.	Gas Consumed.	Carbon Dioxide.	Adults.
Flat-flame No. 6	19·20	10·10	16·80
„ „ No. 5	22·90	12·10	20·00
„ „ No. 4	25·30	13·40	22·30
"London" argand	15·00	7·90	13·10
Acetylene	1·25	2·50	4·50

If we obtained the same amount of light from paraffin lamps, the carbon dioxide evolved would be equivalent to 22·5 adults; while as far as carbon dioxide goes, you might as well invite 32·7 more guests to dinner as use 48 sperm candles to supply the needed illumination.

It has been said that the danger of an explosion from leakage of acetylene is far greater than with coal gas. This is, I think, a mistake. Mixtures of air and acetylene are explosive over a slightly wider range than is the case with mixtures of coal gas and air. But it must be remembered that, if a leakage were caused by a tap being left on, the largest acetylene burner would probably only pass one cubic foot of gas per hour; while an ordinary No. 4 or No. 5 union-jet burner would pass from 5 to 6 cubic feet of coal gas in the same period. From this cause, therefore, it would be far more dangerous than acetylene; and if the leak were from a small crack or a defective joint in a pipe, the rate at which the gases diffuse out would be dependent upon their specific gravity. Coal gas has a specific gravity of ·4, as against ·9 for acetylene. So that through a crack or fissure of the same size only two volumes of acetylene would escape, while three volumes of coal gas would find their way into the air—a difference in rate which would more than cover the slight variation in the limiting proportions of the explosion; and very little experiment will clearly prove that acetylene cannot in any way be looked upon as more dangerous to property than coal gas.

The field for acetylene at the present time is simply enormous, as not only is it specially adapted for the lighting of country houses and small villages and towns where no coal gas supply at present exists, but it will probably in the near future take the place of existing forms of lighting in railway carriages, tramcars, floating buoys, &c.; while as an auxiliary to the electric light for lighthouses, search-lights, and coast defence, it will, I believe, be of the greatest possible value. Should any cheapening of the production of calcic carbide take place, there is even a larger sphere of usefulness awaiting it—a sphere, moreover, in which the troubles found in the consumption of acetylene *per se* will entirely disappear. There are many places in England where the cost of good gas coal makes coal gas prohibitive in price, while on the Continent these troubles exist to a far greater extent; and if it were commercially possible to use acetylene as an enricher of a cheap fuel gas, an enormous field would be opened up.

When acetylene was first rendered a commercial possibility, numbers of experiments were made in order to see if this could not be done. But the results were most discouraging, as, instead of each 1 per cent. of acetylene added to the diluting gas giving a value of about two candles, it was found that it was necessary to add something like 10 to 15 per cent. before the mixture became endowed with any luminosity at all; and that with water gas an admixture with 20 per cent. of acetylene was necessary to give anything approaching a 20-candle gas. With a poor coal gas, however, the enrichment value of the acetylene gives better results, but still not sufficiently good to hold out any great hopes of acetylene replacing oil as a means of enrichment. This curious phenomenon of high illuminating value, when the gas was consumed *per se*, being reduced so enormously when it was used as an enricher, led me to make a long and exhaustive series of experiments on the causes of this being so. I have now found the reason for this apparent anomaly, and also a way in which it can be obviated, with the result that it would be perfectly easy, by a simple and rapid process, to make a fuel gas costing from 8d. to 1s. per 1000 cubic feet, and by the addition of 10 per cent. of acetylene to raise this to an illuminating value of about 20 candles—a result which, given cheap carbide, would open up an enormous field for the employment of acetylene gas.

For use in country houses or generally for domestic illumination, it has been proposed to dilute the acetylene by means of air; apparatus for making the mixture of acetylene and air having been tried both in this country and in America. But so wide is the explosive range of mixtures of this character, that any such appliances would be of the most highly dangerous nature; and should anyone, from want of knowledge, be willing to adopt them, I should expect that the insurance companies would firmly prevent their introduction, by declining to insure buildings in which such methods of illumination were adopted. It is perfectly easy to make a mixture of acetylene and air which will burn with fine effect and a non-smoking flame. But the apparatus employed to give such a mixture is always liable to get out of order; and an alteration in the proportions in which the gases were mixed might lead to the most disastrous results. A safe method of attempting this is to make an acetylene burner in which (in the burner itself) the gas escaping through an injector shall draw in the necessary amount of air for its consumption. But all the burners I have seen on this principle have the drawback of requiring a high pressure of gas in order to work satisfactorily; and even then, the results obtained from them are of a very variable character, and smoking is by no means an unknown thing.

Any other diluent than air would require special apparatus for its production; and this would do away with the charm of simplicity in manufacture which renders acetylene so well adapted for illuminating country houses. It is well known that the carbides of some metals give, on decomposition by water at a slightly elevated temperature, other hydrocarbons, and in some cases mixtures of hydrocarbons and hydrogen. If such carbides are mixed with the calcic carbide, the heat produced by the decomposition of the carbide by water and the slaking of the lime causes the decomposition of the other carbides present, and a mixture of gases is evolved which can be made to approximate to the composition of coal or oil gas. Taking, for instance, the carbide of calcium and aluminium, a mixture of marsh gas and acetylene is obtained, which, while possessing magnificent illuminating power, can be consumed without fear of smoking. If the carbide of manganese be used instead of the carbide of aluminium for mixing with the calcic carbide, a mixture of marsh gas, hydrogen, and acetylene can be obtained; and possibly when the best method of forming carbide has been arrived at, it will be found preferable to use mixed carbides of this character rather than calcic carbide *per se*.

Comparative experiments have been made on the utilization of acetylene and oil gas for railway carriage lighting. It gives for this purpose a most brilliant illumination, as, the source being well above the range of vision, the carriage is flooded with light without any irritation being caused to the eyes. I have travelled in a carriage lighted in this way by the Acetylene Illuminating Company on one of the principal lines; and the ease with which the halfpenny papers could be read and trains looked up in a "Bradshaw" throughout the whole journey indicated that the light was amply sufficient in every part of the carriage. For railway carriages, compressed oil gas, and not

coal gas, is employed; and in order to test the relative values of acetylene and this illuminant, I obtained a cylinder of Pintsch's gas as used on the South-Eastern Railway, and consumed it in a lamp and fittings of the same character as those employed on the line. This gas, when burnt in the burner most suited for its consumption, gives an illuminating value of 52 candles, or 10·4 candles per cubic foot of gas consumed. The following table gives the values obtained by burning it with a double and a single burner in a carriage lantern fitted with a reflector:—

Pintsch Gas.

Position.	Double Burner. Gas Rate, 1·8 c.f. per Hour. Candle Power, Mean of Tests.	Double Burner. Pressure, 1·5 Inches. Candle Power per Foot.	Single Burner. Gas Rate, 1 c.f. per Hour. Candle Power, Mean of Tests.	Single Burner. Pressure, 1·25 Inches. Candle Power per Foot.
Horizontal	18·86	10·477	8·56	8·56
5°	18·86	10·477	8·56	8·56
10	18·62	10·344	8·56	8·56
15	18·06	10·030	8·51	8·51
20	17·60	9·770	8·34	8·34
25	17·46	9·700	8·26	8·26
30	17·42	9·670	8·16	8·16
35	17·40	9·660	7·94	7·94
40	17·22	9·560	7·80	7·80
45	16·04	8·900	7·54	7·54
50	15·04	8·350	7·30	7·30
55	14·08	7·800	6·96	6·96
60	13·08	7·260	6·50	6·50
65	12·22	6·790	6·04	6·04
70	11·50	6·390	5·53	5·53
75	10·00	5·550	4·96	4·96
80	9·00	5·000	4·48	4·48

A cylinder of acetylene made from calcic carbide by the action of water was pumped by Messrs. Pope, and was then tested, when burning from a 1 cubic foot burner, and also from a ½ cubic foot burner in Pope's lantern, fitted with Thomas's reflector. The results were as follows:—

Acetylene Gas.

Position.	Large Burner. Gas Rate, 1 c.f. per Hour. Candle Power, Mean of Tests.	Large Burner. Pressure, 2 Inches. Candle Power per Foot.	Small Burner. Gas Rate, 0·5 c.f. per Hour. Candle Power, Mean of Tests.	Small Burner. Pressure, 2 Inches. Candle Power per Foot.
Horizontal	26·00	26·00	8·60	17·20
5°	26·00	—	8·60	17·20
10	27·00	—	8·60	17·20
15	27·20	—	8·60	17·20
20	27·60	27·60	9·08	18·16
25	27·40	—	9·04	18·08
30	27·10	—	9·00	18·00
35	26·90	—	9·28	18·56
40	25·90	25·90	9·08	18·16
45	25·00	—	8·76	17·52
50	23·00	—	8·54	17·08
55	21·10	—	8·00	16·00
60	20·10	20·10	8·00	16·00
65	18·20	—	7·50	15·00
70	15·65	—	7·30	14·60
75	14·30	—	6·50	13·00
80	12·20	12·20	4·50	9·00

The illuminating power of the cubic foot burner was in this case only 26 candles on the horizontal, instead of 32 candles as in a previous experiment with pure acetylene; and as this loss of light seemed greater than one would expect by absorption by the glass globe, the gas was analyzed, and found to contain 10 per cent. of air. This is, of course, due to the cylinder having been filled for experimental purposes—the difficulty of washing the pumps, pipes, and cylinder free from air for a single operation being very great; whereas, in regular working, 2 per cent. of air or other impurities would be about the limit. This being so, it seemed fairer to make a fresh sample of the gas, and repeat the observations under conditions similar to those which would exist in practice. The gas contained 97·8 per cent. of acetylene; and the results obtained with the cubic foot burner and a pressure of 2 inches in Pope's lantern were as follows:—

Position.	Candle Power of Gas Consumed at 1·05 c.f. Rate.	Candle Power per Cubic Foot of Gas Consumed.
Horizontal	32·00	30·47
5°	32·00	30·47
10	32·00	30·47
15	32·00	30·47
20	33·00	31·42
25	34·00	32·38
30	33·00	31·42
35	32·50	30·95
40	32·00	30·47
45	31·60	30·09
50	30·00	28·57
60	28·00	26·66

An ordinary railway carriage is from 5 ft. to 5 ft. 9 in. in width, and 8 feet from door to door; while the flame is, as a rule, about 7 feet from the floor. The seats being from 15 to 17 inches in height, this would bring the paper or book a passenger was trying to read as nearly as possible 3 feet from the floor. This gives an angle of from 45° to 50° as the important one for the rays that are to be utilized. These results are also confirmed by the tests made by engineers on some of the principal lines, who find that, for railway carriage illumination, acetylene is from four to five times as valuable as the oil gas usually employed; and there is no doubt that this brilliant illuminant is destined to play a most important part in our future illumination.

The lecturer, in conclusion, expressed regret that the time allotted to him by the Society had only enabled him to deal very inadequately with this part of his subject.

AMERICAN GASLIGHT ASSOCIATION.

The Annual Meeting at St. Louis.

(*Continued from p.* 1017.)

The next paper was entitled "Some Experiments in Interior Illumination;" and it was read by Mr. C. H. Page, of Philadelphia (Pa). On a previous occasion, he had directed attention to the fact that the percentage of loss of light by the introduction of an opal globe was less when measured by reflection than when measured direct. The direct loss was 50 per cent. But when the light was moved away from the bar, and a flat screen covered with greyish wall paper put in its place—the screen exposed to the light, but an opaque non-reflecting screen so disposed as to cut off all direct rays from other parts of the instrument—it was found that the loss was reduced to 34 per cent. The author has improved upon this experiment by placing a box 24 in. by 20 in. by 30 in. high at one end of the photometer bar, having an opening 4 in. by 4½ in. towards the disc, and lined with various kinds of wall paper to represent an apartment. This was illuminated by a gas-burner placed in one corner, out of the direct line, which could also be moved into the usual position when required. Taken in the usual way, with and without a 4-inch squat opal globe, the loss was 59 per cent.; but by reflected light, the loss was only 20 per cent. When the globe was covered by an opaque metal sheath of similar size, the loss of light was 68 per cent.; showing that the smaller loss by reflected, as compared with direct light, was due to the light issuing from the top and bottom of the globe, which would not be taken account of in an ordinary photometrical test. Two burners were also compared—one a 2 feet, adjusted to give its best effect; and the other a 7 feet, which was made to give as nearly as possible an equal light. In the first case, the flame was larger and stiffer; but it also had a larger non-luminous area. The efficiency of the 2-feet tip, comparing the direct with the reflected light, was 36 per cent.; and that of the 7-feet tip, was 43 per cent. Two Sugg argand burners were also compared; one adjusted to give its maximum light, the other having a longer chimney to shorten and increase the intensity of the flame. The flame in the first case was 3⅛ inches long; and the efficiency, 47 per cent. In the second, it was 2 inches long; and the efficiency, 40 per cent. In each instance the larger and less intense flame gave the better results. A table was exhibited showing the results obtained by lining the box with paper of various tints.

On discussion being invited, Mr. A. C. Humphreys remarked that it was now established that there was a difference between candle power and lighting effect, which could be explained without impugning the reliability of the photometer. Mr. Page had clearly pointed out that light is changed both in quantity and in quality by reflection. The colour of the reflecting surfaces and the colour of the light, had a marked effect; and therefore lights that were of equal photometric value, might have different practical lighting values. He gathered that, though the flame from the 2-feet tip was larger than that of the 7-feet tip, the effective lighting area was smaller. The reason why the loss shown to be due to the opal globe was so much less by reflection than by direct measurement, was because all the light for the direct test had to pass through the globe; but in the reflection test, a large quantity of light passed without obstruction through the openings at the top and bottom of the globe. To get a fair comparison, the globe should be entirely closed, which was, of course, impossible. The quantity of light that passed through the openings was shown in the paper to be 32 per cent. of the whole. He had before directed the attention of the Association to the importance of testing lights at different angles, and especially with regard to the line of maximum effect; and the experiments now quoted supported his view that photometrical results should be carefully and intelligently interpreted. After allowing for the unobstructed light, the percentages quoted by the author would be considerably changed. He also enlarged on the necessity for care in the details of the experiments. Mr. Harper asked as to the position of the flat flame toward the disc in the tests of direct light; and he said that, in addition to the unobstructed light referred to by the previous speaker, there would be reflection from the interior surface of the globe. The author had spoken of a "standard" opal globe. But opal globes were made of all sorts of thicknesses, and degrees of opacity; and the obstructive power of glass varied greatly according to the thickness, colour, and opacity. Mr. Page's experiments should be extended to take in several varieties of globes, coloured surfaces, &c.; and the results would then be very useful. Mr. Norris ascribed the difference between candle power and lighting effect to the fact that the photometer only measured direct rays; whereas the eye perceives objects mostly by the aid of reflected rays. Lights gave out rays made up of different proportions of the cardinal colours; and the objects

exposed to the rays selected some of the colours only for reflection, absorbing the others. So there was not only the primary reflection from the source of light, but secondary reflection from illuminated objects, that went to make up the lighting effect in a room. Mr. Miller thought it would have been better if the author had kept to his original plan of using a disc of given size, instead of introducing the miniature room. Mr. Rusby remarked that the author had opened up a very important field of investigation. Mr. Beadle said that, up to the present, efforts had been mostly directed to the production of intense local centres of light, which was a mistake, for the eye was not a good photometer, except when it was asked to judge diffused and reflected light. The eye was trained to do its best work by daylight, which was reflected from one object to another, till it was widely diffused and softened in effect. People never looked directly at the sun, because the effect was too powerful; and bright artificial lights in the direct line of vision had the effect of making the eye uneasy and tired. He once carried this idea so far as to fit an opaque reflector under his gas lights, cutting off direct light, and reflecting the whole to the ceiling; and the result was satisfactory. It was important, if a good effect was required, to conceal—or, at any rate, subdue—the source of light; and this accounted for the popularity of artistically shaded oil-lamps. He believed the day would come when the lighting of a room by naked lights, or lights with simple glass globes, would be looked upon as a relic of obsolete barbarism; and he considered that gas engineers might well give careful attention to this question. Mr. Page, in replying to the discussion, effectually disposed of the questions raised as to the details of his experiments.

The next item on the agenda was Mr. F. Egner's paper on "Inclined Retorts up to Date," which has already been reproduced in these columns (see *ante*, p. 904). A notable feature of the discussion which followed was a previously prepared *critique* by Mr. A. C. Humphreys. At first he had thought that the system of inclined retorts would succeed; but some practical trials under his own direction, together with an examination of the best plant at work in England in 1890, tended to change his belief. During the past summer, he had been allowed to visit the Erdberg Gas-Works at Vienna, and inspect the inclined system in operation; and he had also been furnished with statistics as to first costs and operating expenses, that certainly went to show a considerable advantage by this system as compared with others, and a great advance on the original Coze system. Two gangs of seven men each were working ten benches of nines, 12 feet long, in four-hour charges; and these were set face to face, which necessitated barrowing the coke. Some new settings were placed back to back, so as to discharge the coke directly into the coke-yard, which would mean a further saving. The new retorts were also longer, which was another advantage, as the increased capacity was greater than the additional cost. Comparative tables of any kind required to be used with great care and forethought. He passed on to criticize some of the author's tables. Multiplying the maximum daily labour charge by 200, to get the total annual charge, might prove to be misleading. He objected to the introduction of water gas into comparisons of the kind under consideration. Water-gas plant occupied much less ground space; and there were questions as to cost of material, &c. Indeed, the area of land occupied could be considered one of the advantages of the inclined system. He thought they might all follow the author's advice, and give careful attention to the merits of "slopers." Mr. G. T. Thompson said the author had shown that during the comparatively short life of the system, a great advance had been made, both in theory and practice of design and working. Mr. W. S. Miller thought that stoking machinery would be more costly in America than it was in Germany.

In opening a discussion on the prepayment meter, Mr. Blodget said that three years ago, he introduced the system at Williamsburgh; and he found that the prepayment consumers used an average of 1700 cubic feet of gas a month, which was 89 per cent. more than the average consumption on an ordinary 3-light meter, and only 15 per cent. less than the average sale per consumer. He charged a uniform price—5s. 3d. per 1000 cubic feet—to all, with no extra charge to cover the cost of the prepayment meter. The system was not introduced at the instance of the Company, but in response to demands of the consumers. The meters were examined every month; and the consumer was held responsible for any shortage of cash, as compared with the indication of the meter. On only two occasions had he known a deficiency to be found. Mr. A. S. Miller had lately introduced the system; and he thought the consumption would be fully up to the average 3-light meter. Mr. Raynor, after two years' experience with the system at Adrian (Mich.), was well satisfied with the results. Ordinary consumers had a discount of 10 per cent.; but the prepayment customers paid gross price. He had no trouble to speak of about discrepancies; and he took care to put the meters in conspicuous positions. Several speakers were in favour of the system, as likely to secure customers who did not care, or were not reliable, for a long bill. Mr. Harbison remarked that he had given up 3-light meters and service-pipes under 1 inch diameter, as too small for profitable working.

Mr. W. S. Miller next read his paper on "A Modern Retort-House," which we have already reproduced (see *ante*, p. 902). Mr. Littlehales remarked upon it that, while Mr. Miller had put himself in an excellent position by building a house and plant that would turn out 50,000 cubic feet per man per diem, such construction might not be economical in smaller works. Good practice with 100,000 tons per annum might not be equally good for 10,000 tons; and it was possible to put too much machinery in small works. He also thought 10d. per ton a high price for elevating coal. Mr. Butterworth said that at Columbus, he carted coal in waggons a distance of three-quarters of a mile for 7½d. per ton; and he asked the author to name about the smallest sized works to which stoking machinery could be profitably applied. He also spoke favourably of finishing off a roof with boarding, tar, and gravel, in preference to slates, in windy districts. Several details of the paper were also discussed; and Mr. Miller, in the course of his reply, explained that he had to lift his coal 95 feet.

(To be continued.)

THE POSITION OF SULPHATE OF AMMONIA.

The above subject has recently been dealt with in two addresses by Mr. F. J. R. Carulla, the Chairman of the Nottingham Section of the Society of Chemical Industry; and he has called our attention to the matter as being of special interest to readers of the "Journal."

Mr. Carulla's first address was delivered at the opening meeting of the above-named body at Nottingham on the 25th ult. Mr. Carulla first of all referred to a letter, signed "Nitrogen," in the "Chemical Trade Journal" of Aug. 15 last, in which the present undesirable position of sulphate of ammonia was attributed to the inroad of nitrate of soda made possible by the offer of £1000 for an essay to praise the virtues of nitrate some 16 or 18 years ago. He went on to say that it could not be questioned that the literature which arose round this prize must have benefited the nitrate of soda industry. But the effect, in any case, had been gradual; and they must remember that comparatively low prices were experienced in the sulphate market long before the prize essay. In 1867, for example (he took the figures of Messrs. Bradbury and Hirsch), the average price of sulphate was £11 10s. per ton, from which figure it rose to £21 in 1872; coming down to £17 2s. 6d. in 1874, and rising again until 1878, when £20 5s. per ton was realized as an average for the year. This was about the time of the nitrate essay. It would thus be seen that severe fluctuations and low prices were not unknown before its advent. Hence the value of the suggestion that sulphate makers should offer a similar prize to sing the praises of their product was questionable. The money would be better spent in disseminating among farmers the literature they already possessed, to teach the value of nitrogenous manures generally, rather than make any attempt to fall foul of nitrate of soda. The Sulphate of Ammonia Manufacturers' Association, of which his worthy colleague of Manchester (Mr. Geo. E. Davis) was the Honorary Secretary, published an excellent pamphlet as to the use of sulphate that only needed distributing with a little energy to cause surprise to those apathetic manufacturers who looked with indifference on the Association, forgetful of the motto, "United we stand; divided we fall." The speaker then gave figures from estimates made by M. Legrand, who calculated that Belgium uses but $\frac{1}{8}$th, Germany $\frac{1}{16}$th, France $\frac{1}{24}$th, and England $\frac{1}{60}$th of the quantity of nitrogenous manures they might each consume with advantage. He regretted that so valuable a product should be sent abroad, especially at the very low prices that have ruled for some time past, while the British farmer was in sore need of such a cheap manure, now considerably more economical than nitrate of soda. It was still more to be regretted that the value of this fertilizer should be so little appreciated in England; and Mr. Carulla urged all those connected with the sulphate of ammonia interest to unite in an effort to educate the agriculturists by distributing among them appropriate literature. Numerous instances might be mentioned showing how widespread is this want of knowledge. One from a recent letter in the "Standard" would, he said, suffice, wherein the writer looked upon "the difficulty in manuring" as one of the practical drawbacks to the spread of small allotments; plainly indicating the opinion, so largely shared in by people who should know better, that only animal manures were of any service.

The second address was delivered at the opening meeting of the Derby Society of Engineers on the 4th inst. Mr. Carulla, in his introductory remarks, referred to the fact that the Vice-President of the Society (Mr. Berridge) had already brought under the notice of the members the subject of sulphate of ammonia, chiefly from the manufacturing point of view; but he (the speaker) proposed to deal with it from a commercial standpoint. The electric light, enriched water gas, and acetylene—the coming gas—would, he said, contribute to diminish the output of coal gas, and consequently of sulphate of ammonia. Blast-furnaces, on the other hand, especially in times when the iron trade was brisk, would have the opposite effect. In regard to the introduction of plant for the recovery of ammonia at iron-works, Mr. Carulla said: "The Scotch are so often twitted with their economical tendencies as a people, that it may be well to consider how this trait may have contributed to that discovery. How small the quantity of ammonia present in blast-furnace gases must be, you will have gathered from the fact that two scientific experts could not detect its presence. As the gases

leave the furnace, there is perhaps not more than 0·1 grain of real ammonia present in each cubic foot. It may with justice be supposed that only one brought up to see the value of small economies could have thought of saving traces that escaped the observation of trained experts; and certainly it could only have been among an enterprising people, and by a rich firm, that the problem could have been worked out." The speaker went on to say that this branch of the iron trade had attained such proportions that in Scotland the apparatus for collecting the ammonia, tar, &c., from the gases of iron blast-furnaces had already cost £444,600, or more than the iron-making plant of the particular firms possessing the new appliances. It had been calculated that England only uses $\frac{1}{16}$th part of the quantity of nitrogenous manures (sulphate of ammonia and nitrate of soda) which it might consume with advantage; and he thought there was here a field for the employment of all the sulphate that could be made for many years to come, if only the ignorance of the farmer was removed by the dissemination of appropriate literature. Mr. Carulla concluded his address as follows: "We cannot help being impressed by the conviction that great variations will be seen in the sulphate of ammonia market in the future as in the past; that the present depression is only temporary; and that we can hopefully look forward to better times."

Discussion being invited,

The CHAIRMAN (Mr. H. R. Hewitt, H.M. Inspector of Mines), alluding to the refrigerating power of ammonia, mentioned its value for freezing watery strata when sinking pit shafts. Ammonia had, he said, been found of the utmost value for this purpose. He certainly thought, with regard to the value of the unit of nitrogen, that it was a great anomaly that farmers should be willing to pay more for it in nitrate of soda than in sulphate of ammonia. In connection with acetylene, he asked Mr. Carulla whether there was not considerable danger in its use in case of leakage.

Mr. WOLFF remarked that it had been said in the address that "only the ignorance of the farmer had to be overcome." But it was his experience that this was rather a big "only." He remembered trying to convince a farmer that in a certain case phosphates would be useful; but it was no good, as the farmer's whole idea was to use lime. Such cases were frequent, even in Derbyshire, where lime abounded in the soil, and there was more than enough for the requirements of the crops. With regard to refrigerating arrangements, their use was increasing, especially in America, where already the pipes for warming the railway carriages in winter had been used in summer to circulate a cold current by means of ice. This was done in England for the first time last year in the Queen's Saloon, when going to Balmoral. He would point out, in regard to water gas enriched by oil, that it had a much higher calorific value than ordinary coal gas and required more air for its combustion; and its superiority over ordinary coal gas for illuminating purposes was, therefore, questionable. There were very varied opinions as to the amount of acetylene that might safely escape into the air of a room. Some said more, and others less, than in the case of coal gas. He should like to know who was right.

Mr. G. HYDE said that recently he had occasion to look up statistics concerning illuminants, and he had found that the annual increase in the additions to gas-works since the introduction of the electric light had been greater than the cost of the electric light installations. Indeed, the latter had not amounted to one-half of the cost of the additions to gas-works. Even in Derby the increase in the output of gas, notwithstanding the introduction of the electric light, had been most remarkable.

Mr. J. W. SMITH thought the use of coal gas for heating purposes was spreading at such a rate as to more than make up for any diminution due to the electric light. He knew for a fact that in one place the use of gas-stoves for heating and cooking had injured gas as an illuminant, not because the quality had deteriorated, but on account of the diminished pressure—the demand being really greater than the works could supply.

A vote of thanks having been accorded for the address,

Mr. CARULLA, replying to the discussion, said the presence of phosphide of calcium in some early specimens of carbide had given rise to dangerous accidents owing to the formation of phosphoretted hydrogen, which ignited on coming into contact with air. If, therefore, any air was left in the acetylene receiver, an explosion under such circumstances was almost sure to occur. Speaking from memory, the limits of explosion for mixtures of acetylene and air were 3 per cent. and 82 per cent.; whereas for coal gas they were only 6 per cent. and 29 per cent. The chances of explosion in case of leakage were unquestionably much larger in the case of acetylene than in the case of coal gas. He was unable to say which was the more poisonous—coal gas or acetylene; but, judging from its offensive smell, probably acetylene. The reference made by Mr. Wolff to the subject of lime as a favourite manure reminded him to mention that lime in the caustic form should be kept away from sulphate of ammonia if this was not to be completely spoilt, as the ammonia was driven off when the two substances were brought together. This point was of such importance that in all sulphate of ammonia literature it should be boldly printed on every page that lime and sulphate should never be brought together. Failures, doubtless, had occurred through this cause; and sulphate might have been discredited, when the want of success was only due to ignorance. Intelligently used, sulphate of ammonia was by far the most valuable nitrogenous manure we possess.

THE USE OF ACETYLENE FOR MOTORS.

Herr A. von Ihering, of Hanover, gives in the "Journal für Gasbeleuchtung" a useful summary of researches by himself and others on the use of acetylene in gas-motors. The following is an abstract translation of his article:—

Ravel has made practical trials of acetylene for motors in France; and he previously endeavoured to gain an accurate knowledge of its explosiveness and other properties. The limits of the composition of the explosive mixture with air are 0·75 volume and 20 volumes of air to 1 volume of acetylene; and the maximum force is developed with 12 volumes of air to 1 volume of acetylene. Le Chatelier found the maximum rate of propagation of flame to occur with 10 per cent. of acetylene in the mixture; and the rate was then 19·7 feet per second, which greatly exceeds that of a similar mixture of coal gas with air. The temperature of ignition is about 900° Fahr., while that of other gaseous mixtures is not below 1100° Fahr. An acetylene mixture in a glass tube ignites, on application of heat, before the glass softens. The temperature of the combustion of acetylene is, however, high. Equal volumes of oxygen and acetylene give a temperature of 7230° Fahr. Lothar Meyer first called attention to the very violent and dangerous character of the explosion; and he attributed it to the low hydrogen content of acetylene, and the consequently large ratio of carbonic acid to aqueous vapour in the products of combustion. The characteristics of acetylene, therefore, are: (1) Great rate of propagation of flame; (2) low temperature of ignition; (3) high temperature of combustion; and (4) great explosive force.

Ravel used Fournier's apparatus for generating the acetylene for his researches; and it left the small gasholder at a pressure of about 6½ inches. The gas-engine he employed was constructed on Clerk's principle; and therefore the cycle of operations was completed in two strokes. The ignition was by an electric spark. This motor was tested with coal gas, and with mineral oil of ·71 to ·72 specific gravity, as well as with acetylene. Each trial with acetylene was immediately followed by one with coal gas, in order to gain a clear impression of the force of explosion of the two gases under precisely similar conditions. It was found that the motor required at least double the quantity of oil for cylinder lubrication when acetylene was used that it did when coal gas was employed, and that the cooling of the cylinder also had more effect on the work accomplished. The most favourable results obtained by Ravel showed about 176,000 foot-pounds per cubic foot of acetylene consumed in the 2-horse power motor at the rate of about 11½ cubic feet per hour. Coal gas in the same engine showed about 83,000 foot-pounds work per cubic foot. Therefore in this small motor, acetylene accomplished, volume for volume, 2·1 times as much work as coal gas. Ravel found with acetylene that the violence of the explosion rendered it very difficult to make the whole of its energy do useful work on the piston.

The somewhat unfavourable results of Ravel's experiments should not deter investigators from making others. They were not sufficiently numerous to form the basis of a final judgment; and, moreover, a motor of which only every fourth stroke was a working one would permit each step to be followed more precisely than did Ravel's motor. The author found the consumption of coal gas to be 2·7 times that of acetylene per indicated horse power; whereas Ravel found it to be only 2·5 times. But in the author's trials the indicated horse power was 4·95 to 5, against 2·13 in Ravel's researches. This appears to prove that, as the size of the motor increases, acetylene gives, relatively to coal gas, more favourable results.

Taking the very low estimate of £7 10s. per ton which has recently been made as the cost of calcium carbide at Spray, North Carolina, and a yield of 10,765 cubic feet of acetylene per ton of carbide, one indicated horse power would cost, on Ravel's figures, about 2·3d. Taking coal gas at 3s. 5d. per 1000 cubic feet, and the consumption found by Ravel, one indicated horse power would cost about 1·37d., or not quite two-thirds of its cost from acetylene by the above estimate. But taking the ordinary price for calcium carbide which has prevailed up to the present—viz., £20 per ton—one indicated horse power from acetylene would cost about 6d., or more than four times its cost when produced from coal gas.

The Gas Production of Berlin.—The total production of the municipal gas-works in Berlin for the financial year 1895-6, according to the report just issued, was 3,889,600,000 cubic feet, which is an increase of 6·1 per cent. on the production of the preceding year. The gas used for cooking, heating, and industrial purposes has increased by 34·8 per cent. There was a great falling off in the returns from residual products; nevertheless the year's working showed a surplus of 4,104,724 marks (nearly £205,000), of which 3,650,513 marks (about £182,500) was handed over to the city chest.

REGISTER OF PATENTS.

Pipe-Joints for Water-Taps, &c.—Thomas, O., of Risca, and Dyer, J. H., of Pontymister, Mon. No. 20,188; Oct. 26, 1895.

According to this invention, as applied to a water-tap, the lead pipe or connection to the tap is telescoped into a chamber (of brass, gun-metal, or other metal, tinned internally) incorporated with, or connected to, the tap, as shown in the engravings.

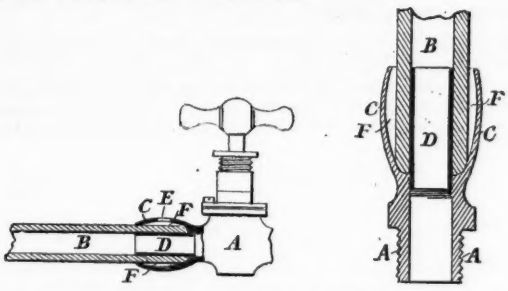


Fig. 1 represents a tap A connected to a horizontally disposed lead pipe B inserted in a metal chamber C connected to the tap. The chamber C is tinned internally so as to ensure the adherence of solder; and extending along the middle of the chamber is a ferrule or tube D, either screwed to the chamber C, or otherwise secured to it, or it may be made in one piece with it. The pipe B fits over the ferrule D, as shown. Prior to inserting the pipe in the chamber C, the part of the pipe which is to be contained in the chamber is burnished externally. After the insertion of the pipe in the chamber, the latter is heated by the application of a plumbers' blow-pipe or other flame; and a stick of solder is held at the aperture E provided in the wall of the chamber. The solder as it fuses drops into the chamber C, and fills the space F between the exterior of the pipe B and the interior of the chamber, the mouth of which fits the pipe B sufficiently closely to prevent escape of the solder.

Fig. 2 illustrates the application of the invention to connecting a cistern union A to a lead pipe B, vertically situated. When the pipe is vertical or sufficiently inclined, the solder is charged into the chamber C at its mouth, which is amply large for the purpose. As in other cases, the ferrule D may be either screwed in place, as shown, or otherwise fixed, or it may be made in one piece with the chamber C.

Gas Heating-Apparatus.—Schoonjans, G., of Brussels. No. 24,012; Dec. 14, 1895.

This apparatus is designed for use in smelting and other such operations; the generation of intense heat being obtained, which only radiates through the upper surface. The apparatus consists of a bunsen tube, upon which is placed a burner-head of fire-proof material, provided at its sides with orifices encircled by recuperators of semi-globular or truncated conical shape, and made of some suitable non-conducting material. Free space is left on all sides except above; so that the air supply can only enter the flame by the radial openings or channels in the walls of the recuperators. In this way, the air, before entering the channels, becomes heated in the space formed around the outer wall surface of the recuperators, into which it enters by openings connected below with a disc provided for the purpose.

Charging Air with Combustible Matter, and Applying it for Illumination.—Denayrouze, L., of Neuilly, France. No. 24,381; Dec. 19, 1895.

This invention relates to means for charging air with combustible matter—such as the vapour of liquid or solid hydrocarbons, or with pulverulent matter, like charcoal powder, lycopodium, and the kind—and applying the air so charged for illumination. The chief object aimed at by the patentee is to effect the charging of the air at the lamp itself, to which air under pressure is supplied; the mains and service-pipes now used for gas being available for this purpose.

The arrangement of the lamp would vary according to the combustible matter employed. When this is a volatile hydrocarbon liquid, the air under pressure is supplied by the ordinary service-pipe to a chamber in the lower part of the lamp, and issues in a jet across the mouth of a small pipe which dips into the liquid below—thus causing a finely subdivided spray of the liquid to flow with the air current against the vanes of a fan, which revolves in a casing communicating with the burner, and serves to mix the air and hydrocarbon. The fan is driven merely by the impact of the current on its blades, or by an electric or other motor. When the hydrocarbon is solid (such as naphthalene), it is contained in a vessel some distance above the flame, by the heat of which it is kept in a state of fusion, while the air blows over its surface and takes up vapour from it. When fine powder is used, the patentee mounts at the bottom of the vessel containing it a small feed roller, which is caused to revolve slowly by gearing connecting it to the rapidly revolving mixing-fan. As the roller revolves, it carries on its surface a coating of the combustible powder; and the jet of air, being directed on this, blows it off into the fan chamber, where, after the air and powder are mixed, they proceed to the burner.

Valves for Gas and Water Pipes.—Preston, E. J., and Cornish, A. T., of Deptford. No. 24,625; Dec. 23, 1895.

These improvements in valves for pipes for water, gas, and other fluids under pressure, refer especially to means for keeping their spindles fluid-tight without the use of hemp-packed stuffing-boxes.

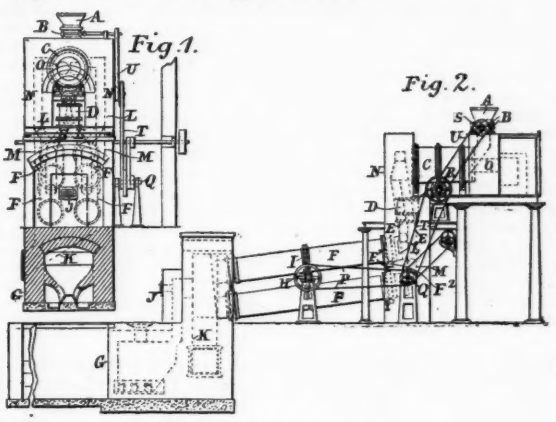
In valves used in connection with apparatus for drilling and tapping mains under pressure, and for connecting branch or service pipes thereto, the patentees make the valve in the form of a plug screwed externally for working in the "ferrule," screwed inside and out; and they provide the plug with a deep square recess. To operate the plug-valve, there is a spindle square in its lower part, so as to be capable of working up and down in the recess of the plug, and round at its upper end where it works in the pipe connection. To prevent leakage, the spindle is provided at this place with a hat leather, cup leather, or joint washer, held in place by a ring nut; and in the upper end of the spindle is formed a square recess for a corresponding key to fit in, for turning it by, as well as the screw plug or valve. This key is inserted through a cap on the pipe connection.

Street-Lamps.—Loftus, Sir A. J., of Handsworth, and Rowland, E., of Birmingham. No. 266; Jan. 4, 1896.

The patentees propose to produce each of the panes of a street-lamp from a circular sheet of glass formed as a lens, with a curve such as is described in patents Nos. 20,023 of 1889 and 14,034 of 1891. From this circular lens, a pane of glass is cut of square, rectangular, or other required configuration, making its edges suitable for fitting within or against the metal strips of the lamp body. In this manner, the lantern has the entire surface of each pane or glass front formed as a lens; "and thus any light which does not pass through the glass is reflected back from the curved surface, and transmitted through the opposite side of the lantern."

Revivifying Spent Lime.—Hislop, G. R., of Paisley. No. 759; Jan. 11, 1896.

This invention—relating to apparatus for revivifying spent lime of gas-works and for calcining cements, ores, lime from soda ash, spent bleaching powder, alkali waste, small lime stone, oyster shells, chalk, or like materials—has for its object "to make provision for more completely exposing the lime or other material to the action of hot gases, by causing any of the material in a reduced condition to traverse rotating furnaces or chambers of extremely small diameter, serving to turn it over and expose it to close contact with the hot gases which flow through the chambers in an opposite direction."



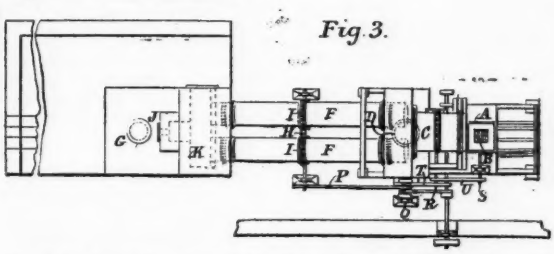


Fig. 1 is a front elevation of the plant; fig. 2, a side elevation; and fig. 3, a plan.

It comprises a hopper A, into which the spent lime is led, and from which it is fed through crushing-rollers B, and thence by a conduit into a drying cylinder C. This cylinder is arranged to rotate on an approximately horizontal axis, and is provided with ribs or bars internally, to facilitate the stirring up of the material passing through it. The material under treatment is delivered from this cylinder into a distributor D rotated by bevel gear, oscillated by suitable means, and having a number of outlets, which are in turn uncovered to permit the discharge of material (alternately or otherwise) to a corresponding number of shoots E, leading each into a rotating tubular furnace or chamber F, in which the lime is calcined. By preference, the drying cylinders and calcining chambers are arranged in batteries enclosed in brickwork or masonry; a gas producer or furnace G, with a number of calcining tubes or chambers F, being generally provided for each drying cylinder C. The rotating chamber F is operated in unison by suitable gearing, in which worms H gear with worm-wheels I surrounding the tubes F. The calcining tubes F, which are preferably of not more than 8 or 9 inches internal diameter, but may be even smaller, are slightly inclined; and their lower ends terminate in the combustion chamber of the gas-producer G. The gas generated in the latter mixes with air admitted to the combustion chamber, by means of a damper J situated in proximity to the ends of the calcining-tubes F, so as to develop a very high temperature there. The hot gases pass directly into the suitably lined chambers F, and force their way through them in close contact with the lime, which is being stirred up or turned over, as it proceeds through the tubes, by their rotation. The material falling through the ends of the tubes F collects in a chamber K below, having preferably an inclined floor and an outlet closed by a door, on opening which the material drops out of the apparatus. The spent gases as they leave the calcining-tubes are led by conduits L M, formed in the brickwork N, into the drying

cylinder C, whence they pass into a chimney flue O; being utilized in the primary cylinder for drying the material, and for discharging a portion of the sulphuretted hydrogen, in the case of gas lime, by means of the carbonic acid in the gases.

Owing to the small diameter of the calcining-tubes (which just suffice for carrying off the hot gases from the producer or furnace G), the lime passing through them in a fine stream is subjected, says the patentee, to more intimate contact with them than is possible with tubes of greater diameter, in which latter case the gases pass along the crown of the tubes without sufficient contact with the material; and because of the high temperature of the former tubes, comparatively short travel and little time are needed to effect the revivifying or calcining operation.

The calcining-tubes F and drying cylinder C are carried on rollers or pulleys—the former tubes being maintained in their inclined position by rollers bearing against flanges on the outside of the tubes. The shaft which carries the gear for rotating the calcining-tubes is driven by belting from a counter-shaft Q, from which the shafts R S, operating the drying cylinder and the crushing-rolls respectively by similar gearing, are also driven by means of belting T U, so as to ensure comparatively uniform feeding forward of the material under treatment.

Gas-Burners.—Williams, W. B., of Leigh. No. 1336; Jan. 20, 1896.

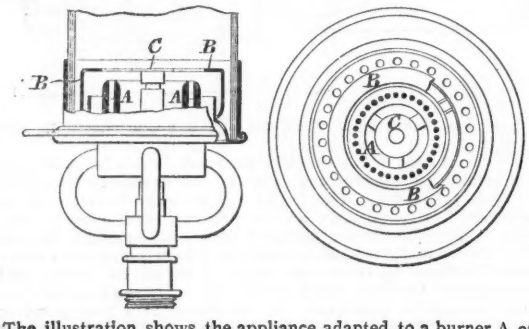
This invention consists first in forming the steatite portion of a gas-burner of semi-spherical form, and providing it with a number of fine holes, arranged in a line from side to side, and radiating outwards from the burner interior; and, secondly, in making the inlet end of the burner closed, and of forming fine holes in the closed end. In using this "improved burner," says the patentee, and with the usual sieve or grid removed, the burner forms a chamber equivalent to that produced by the burner attachment described in patent No. 7831 of 1893; and the illuminating effect of the attachment is thus obtained in the burner itself.

Igniting Devices for Gas-Burners.—Schwarzschild, A., of Frankfort-on-the-Main. No. 5203; March 7, 1896.

This invention relates mainly to the ignition of incandescent gas-burners by means of a platinum wire, either brought to incandescence by self-ignition with the aid of platinum-sponge, or by electricity. Such igniting-devices as usually constructed present the disadvantage that the platinum wire (which, in order to serve for the purpose in question, must be made very thin) is easily broken and rendered useless after a comparatively short time—due to mechanical causes or influences, in so far as the wire brought to incandescence is unable "to permanently resist the continuous impact of the gas against it, and is thus soon ruptured." Based on this observation, the patentee provides the igniting platinum bridge with a mantle or cover of wire network, or perforated sheet metal, or the like. But as the incandescent platinum wire would not ignite the gas, if it were completely enclosed, the wire is left open at one or more places, none of which latter, however, lie immediately opposite the gas-jet passing out of the burner. The ignition takes place readily through the open places in the mantle or cover without the platinum bridge or wire proper being exposed to the direct impact from the gas-jet to be ignited, and without consequently being injured thereby.

Increasing the Illuminating Power of Gas under Combustion.—Lavender, R., of Finsbury Park, N., and Tice, W., of Westminster, S.W. No. 5336; March 10, 1896.

This invention is designed to increase the illuminating power of coal or other gas, by placing over or on the burner (whether argand or otherwise) a disc or cap of metal or other suitable material, in such a position as to divert the outer column of air into the blue or bunsen flame at its exit from the burner, combined with which "is placed, in or upon the centre tube or carrier, a cone, disc, or cap, perforated or otherwise, for directing the column or current of air from the inside also into the flame."



The illustration shows the appliance adapted to a burner A of the argand type. B is a metal cap surrounding the burner; the air entering it from below. This outer column or current of air is diverted by it into the base of the flame. C is the disc which directs the inside column or current of air to meet the flame; this disc being on the same level as the top of the cap.

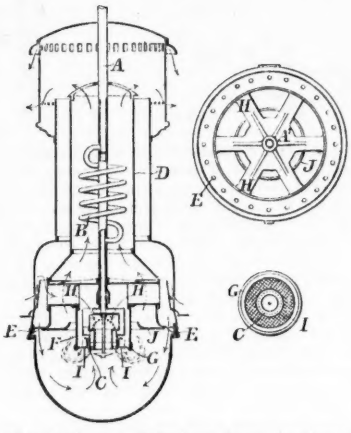
Making Generator Gas.—Dowson, J. E., of Old Queen Street, S.W. No. 6919; March 30, 1896.

These improvements relate to apparatus to be used for the production of combustible gas formed by passing air only, or steam and air together or successively, through incandescent fuel in a gas generator or producer. One part of the invention relates more particularly to a generator in which hard fuel—such as anthracite or coke—is used; another part relates more particularly to a generator in which softer fuel is used—such as semi-bituminous or bituminous coal, lignite, &c.

The generator for hard fuel may be made in the usual way, with an iron body lined internally with refractory bricks, with a feeding hopper near the top, and a fire grate and doors near the bottom. It is also provided with suitable means for the supply of air or of steam and air, to be used together or successively as preferred—such steam and air being provided in any of the well-known ways, or in any other manner The improvements consist chiefly in having a grate the area of which is appreciably smaller than the sectional area enclosed by the brick or other lining of the generator, on the level of the grate or immediately above it. By this means, it is possible to make the bulk of the steam or air, or of the steam and air together, pass upwards through the middle portion of the fuel. Thus less clinker is produced near the lining of the generator, and the apparatus works with a comparatively low grade of fuel; while at the same time the gas produced is said to be improved in heating power.

Regenerative Gas-Lamps of the Wenham Type.—Robinson, S. H., of Streatham Common, S.W. No. 10,331; May 14, 1896.

This invention consists in the combination with a Wenham gas-lamp of a helically coiled tube, arranged within the passage for the combustion gases, through which coil the gas is made to pass on its way to the burner.



In the engraving is shown a Wenham lamp having these improvements applied thereto—a vertical section through the lamp, a cross section, and an underside view of the steel nozzle and burner of the lamp.

According to the present invention, the gas-supply pipe A is not continuous down to the burner; the lower part being separated from the upper by a partition. The gas-pipe B is helically coiled with the upper end connected to the pipe A; while the lower part is so arranged that the gas is made to flow through the coil before passing to the burner C. By this means the gas, in flowing through the coil (which is heated by the combustion gases passing up through the chimney D from the burner) becomes heated to a considerable extent before it enters into combustion at the burner with the air supply, which is also heated by the well-known action of the regenerator H of the Wenham lamp. By this mode of heating the gas supply, it is claimed that a flame "of greatly increased brilliancy is produced."

The air supply to the lamp globe is admitted through holes E, formed in the circumference of the plate of the air-chamber, near to the periphery. The holes are made in an outward inclined direction; so that the entering air will flow downwards close up to the inner surface of the globe (as indicated by the arrows) before rising up to the flame, whereby the eddying air currents caused by the arrangement usually employed are avoided, and the globe is kept comparatively cool.

F is a thin nickel steel nozzle surrounding the burner, for leading the heated air supply to it, in lieu of the cast-iron nozzle heretofore employed. It is fixed to the regenerator H by means of a flange and screws, so that it can at any time be replaced by a new one. On its lower end is fixed the ring G, for securing the perforated plate I. J is the reflector, with an inner turned-up lip, leaving an annular space round the nozzle F for the escape of the combustion gases. It will be seen that, by this construction (says the patentee), the flame of the burner does not come into contact with the reflector; so that there is less danger of smoking, cracking, or burning of the same than heretofore.

Air-Carburettor.—Pengeot, A., of Valentigney, France. No. 14,213 June 26, 1896. Date claimed under International Convention, April 13, 1896.

This apparatus for carburetting air for supplying hydrocarbon gas-engines, consists of a carburettor in which the liquid is volatilized by capillary surfaces arranged so as to expose an extended area to the air passing through. The apparatus consists of a receiver containing one or more diaphragms of capillary material, and provided with an air-inlet, carburetted air-exit, and liquid inlet passage. The capillary diaphragm is in all cases constantly immersed to an invariable depth in the liquid, which is maintained at a constant level by any suitable means, and which ascends by capillarity, so that the diaphragm presents surfaces constantly impregnated with the hydrocarbon liquid. The air is either caused to traverse the diaphragms of capillary material in a state of extreme sub-division, and so becomes charged with the vapour, or else it does not traverse the capillary material, but becomes carburetted by licking the surfaces of the capillary diaphragms when they are saturated with liquid hydrocarbon.

Lighting Incandescent Gas-Lamps.—Grosch, R., of Weimar, Germany. No. 14,505; June 30, 1896.

This apparatus for lighting lamps fitted with incandescent gas-burners, is so arranged that on raising the flap or valve that serves to close the bottom of the lamp, there are opened simultaneously the gas-tap for the igniting apparatus and the main gas-tap for the burners.

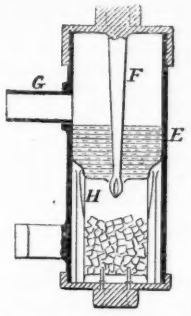
The ignition of the flame of the igniting apparatus at once effects the ignition of the gas delivered to the main burners; the arrangement being such that on the removal of the lighting-lantern from the incandescent lamp, the gas-tap for the igniting apparatus is shut again automatically.

Gas or Vapour Engines.—Baker, H. C., of Hartford, Conn., U.S.A. No. 15,045; July 7, 1896.

This invention relates to gas-engines of the class in which the power or driving the piston is derived from the explosion within the piston-cylinder of a combustible mixture—such, for instance, as a mixture of air and the vapour of naphtha or other volatile liquid hydrocarbon. In the limits of space at disposal in these columns, it is impossible to give an intelligible abstract of the patentee's proposals. His specification extends to more than fifteen pages of print, with twenty-six distinct claims for the invention; and there are six sheets of elaborate drawings inseparably connected with it.

An Acetylene Supplied Street-Lamp.—Clarke, W. C., of New York. No. 17,451; Aug. 7, 1896.

The patentee proposes to attach to the outside of an ordinary street-lamp column, just clear of the ground, an acetylene gas generator of the form shown in the engraving. It consists of a cylinder E, provided at each end with a removable cap, by which it is closed gas-tight. The upper cap is provided with a cutting or crushing device F, projecting into the cylinder when the cap is screwed into place, so as to force it downward into a cartridge H of carbide of calcium placed therein. The



lower cap may also be provided with projections, which, when the cartridge is forced against them by the action of the device F, will pierce the lower end of the cartridge. The cylinder is connected near its upper end with the gas-lamp column by a pipe G. In using the device, the upper cap of the cylinder is removed, and a water-proof cartridge containing carbide of calcium is inserted therein; and a quantity of water sufficient to effect the decomposition of the carbide is poured into the cylinder above the cartridge. The top cap is then screwed on, and the crusher F is forced into the end of the cartridge, so that the water can pass in and combine with the carbide. The gas as developed passes to the lamp-burner, where it is consumed as required.

Incandescent Gas-Burners.—Gäbel, A., of Dresden. No. 18,956; Aug. 27, 1896.

This invention relates to a burner-head for incandescent gas and similar lamps, which contains four new "details"; (1) In metallic head "riddles" with interchangeable ribs stamped through below and above; (2) a shade-holder consisting of two metallic plates stamped out, and connected with each other without riveting and soldering; (3) a horizontal ring with a bell provided with openings, which ring will be put round the part of the tube which has the openings for the air entrance for regulating the flow of air in the mixing chamber; and (4) a fastening of the insulating ring without any thread.

Incandescent Gas Mantles.—Wellstein, H., of Berlin. No. 19,957; Sept. 9, 1896.

This invention has for its object to produce incandescent mantles "with a faultlessly even distribution of their material." For this purpose, "threads or yarns of suitable material and strength, immediately after their manufacture, are washed and bleached, and then saturated with a solution of thorium oxide, or of one or more other suitable metallic oxides, and then knitted or eventually also woven into a tubular or other suitable form, without its being necessary to again wash or clean the material, and without fear of the fibres becoming more closely accumulated at certain places, or of an unequal saturation being caused with the impregnating substances." Such mantles (says the patentee) show a complete even distribution of the material on their periphery; and, in consequence of this, they give off "an entirely even light."

Incandescent Gas-Burners.—Bode, P., of Berlin. No. 19,739; Sept. 9, 1896.

This invention has for its object to provide an incandescent gas-burner which effects a preliminary heating of the mixture of gas and air before combustion, "thereby raising the heating and lighting effects of the flame."

The lower part of the bunsen tube is provided with a larger number of air-inlets than are usually employed. These inlets are surrounded by a grid with inclined air-inlet slots. The upper part of the bunsen tube projects into two concentric tubes—one provided with a top closing plate and with outlet slots at the bottom, and fitted over the bunsen tube—an annular space being left between the two tubes. Its concentric position is assured by means of ribs. The other tube has at its upper end an inwardly projecting roll, on which specially shaped loose parts rest. The outer part consists of a simple ring with undulating or fluted outer surface; the inner part being surrounded both inside and outside by flat rims. The inner flat rim is closed underneath by a plate, which carries on its upper side the central socket for the carrier of the incandescent mantle.

When the burner is in use, the gas which rushes upwards through the inlet draws in atmospheric air, which is caused, by the slots mentioned, to enter the bunsen tube in an inclined direction. By this means, a rotary movement is imparted to the ascending layers of air; and consequently the mixture of the gas and air necessary for the noiseless burning of the flame is produced in the bunsen tube itself. The mixture of gas and air then flows in a zig-zag manner through the circular spaces and ways or channels of the burner body; the flame produced being the shape of a hollow globe with rather thick enclosing surfaces. By means of the metal in the channels, the heat from the flame is carried downwards; and a preliminary heating of the mixture collected in the circular spaces is thus effected.

Mounting Incandescent Gas-Burner Mantles.—Lake, H. H.; a communication from W. H. A. Sieverts, of Hamburg. No. 20,992; Sept. 22, 1896.

This invention relates to a method of attaching incandescence mantles to their burners, by causing the lower part of the mantle to contract upon (and may be fused with) the head of the lamp-burner, and the top part of the mantle to be likewise brought into intimate contact with the portion attached to the frame supporting the mantle. This contact is obtained by exposing the mantle at the extremity to be contracted to the action of a jet-flame passing from the outside toward the inside, whereby the mantle is softened and forced against the burner or head respectively.

APPLICATIONS FOR LETTERS PATENT.

26,933.—Grove, J., "Gas or oil engines." Nov. 27.
26,937.—Hall, J. W., "Regenerative furnaces." Nov. 27.
26,965.—Boardman, F. R., "Electrically lighting incandescent and other gas-burners." Nov. 27.
27,036.—M'Arthur, A., "Gas-heated smoothing irons." Nov. 28.
27,041.—Sayer, W., "Conduits for gas-pipes, electric wires or cables, and other analogous purposes." Nov. 28.
27,042.—Pollock, R., "Oil and gas engines." Nov. 28.
27,085.—Gillet, S. D., Forest, G., and Bocande, J. E. O., "Apparatus for lighting by acetylene gas." Nov. 28.
27,086.—Gillet, S. D., Forest, G., and Bocande, J. E. O., "Burner for lighting by acetylene or other gases rich in carbon." Nov. 28.
27,137.—Cumine, J. A., and Dexter, E. J., "An improved illuminant." Nov. 30.
27,163.—Main, R. B., "Portable gas-oven." Nov. 30.
27,194.—Hargreaves, A. J. de P., "Manufacture of acetylene gas." Nov. 30.
27,207.—Pennington, E. J., "Electric ignition of charges in explosive engines." Nov. 30.
27,208.—Pennington, E. J., "Suppressing the noise of the exhaust from internal combustion engines." Nov. 30.
27,210.—Harrison, H. T., "Prepayment gas-meters." Nov. 30.
27,212.—Wetter, J., "Generating acetylene gas." A communication from G. Meyer. Nov. 30.
27,216.—Valon, W. A. M'I., "Lamps." Nov. 30.
27,236.—Pinckney, P., sen., "Combined gas and steam engines." Dec. 1.
27,237.—Kenyon, J. H., "Incandescent gas-burners." Dec. 1.
27,245.—Birtwisle, J., "Gas and oil motors." Dec. 1.
27,269.—Boult, A. J., "Incandescent gas lights." A communication from De Ruyter Hollins. Dec. 1.
27,271.—Boult, A. J., "Indicators for gas apparatus." A communication from The United Gas Improvement Company. Dec. 1.
27,338.—Thomson, B. T. L., "Manufacture of acetylene gas." Dec. 1.
27,369.—Dent, C. H., "Incandescent gas-light air-filter or dust-screen." Dec. 2.
27,449.—Chateau, J. D. C., "Igniting and extinguishing gas from a distance." Dec. 2.
27,457.—Braun, S., and Schlesinger, H., "A new lighting gas." Dec. 2.
27,467.—Boult, A. J., "Regulating valves for the supply of liquids or fluids under pressure." A communication from H. H. Dikema. Dec. 2.
27,494.—Riepe, E., and Offermann, G., "Regenerative furnaces." Dec. 3.
27,496.—Baker, F. E., "Application of acetylene or water gases for the purpose of propelling or driving engines or motors." Dec. 3.
27,546.—Canellopoulos, J., and Kratz-Boussac, H. O., "Gas-igniters." Dec. 3.
27,568.—Johnson, C. M., "Oil and gas motors." Dec. 3.
27,574.—Gossart, E., and Chevallier, H., "Production of acetylene gas, and lamps therefor." Dec. 3.
27,576.—Epstein, G. J., "Gas or oil engines." Dec. 3.
27,597.—Kent, H. A., "Self-lighting gas-burners." Dec. 4.
27,697.—Lake, H. H., "Acetylene gas generators." A communication from V. Hanotier and G. Hostelet. Dec. 4.
27,744.—Kiesewalter, A., "Manufacture of a carbide which, by its decomposition by water, produces acetylene gas." Dec. 5.
27,754.—New, A. G., "Electrical ignition apparatus for oil and gas engines." Dec. 5.
27,757.—Arndt, M., "Process and apparatus for automatically indicating, recording, and regulating the percentage volume of a particular kind of gas in a gaseous mixture." Dec. 5.
27,765.—Woodhouse, S. J., "Gas-gauges." Dec. 5.
27,807.—Raupp, K. H., "Burner for acetylene or other similar gas." Dec. 5.

The Rhymney Water Schemes.—The Rhymney District Council have resolved to open negotiations with the Rhymney Iron Company, Limited, for the purchase of their water-works, and to oppose the Rhymney and Aber Valleys Gas and Water Bill (see *ante*, p. 1078).

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Professor Lewes on the Illuminating Power of Various Burners.

Sir,—I have read with much interest the reports in your issues of the 1st and 8th inst. of Professor Vivian B. Lewes's lectures, delivered at the Society of Arts, on "Domestic Illumination by Means of Gas." There are, however, certain conclusions at which Professor Lewes appears to have arrived without, in my opinion, sufficient proof.

In comparing the illuminating value of various burners at certain angles below the horizontal, Professor Lewes takes a regenerative lamp, part of the construction of which is a reflector, and compares it, at low angles, with a Welsbach burner without any reflector. This is manifestly a ridiculous comparison, as Welsbach burners are always fitted with downward reflecting shades when the light is required to be thrown down on a table or elsewhere. But this is not all. He does not even allow the Welsbach burner the advantages it would have, even without a reflecting shade, in an ordinary room; for the tests were made in a darkened room, in which all objects were carefully blackened, whereas that is not the description of room where people generally sit.

Professor Lewes, however, makes a second series of tests in a room with light distempered walls and white ceiling, with the result of establishing the practical superiority of the Welsbach in an ordinary room, as, even without the aid of reflectors, 8·6 candle power per cubic foot was obtained at 40 degrees below the light—an amount which the regenerative gives only vertically below it, while all above the horizontal, in the latter case, is perfectly dark. It would have been interesting if Professor Lewes, in his tests in a room with a white ceiling, had given the illuminating value of the Welsbach immediately below the lamp, as such a test would tend to remove the bad impression of his "unreadable" test in Table I. (*ante*, p. 1070).

Professor Lewes, on the strength of these tests, forms the remarkable conclusion that the regenerative burner, immediately above the table, yields by far the best results. He, however, gives no proof of this, as he has not given the results to be obtained on a table directly below the Welsbach burner in an ordinary room with a white ceiling. Moreover, if the Welsbach light is to be judged without its usual reflector, it should at least be credited with a large and pleasantly diffused light reflected from a white ceiling.

It is, however, when we come to Table III. (p. 1071), which gives the results of experiments made by Major G. K. Scott-Moncrieff, that the triumph of the Welsbach system is established. Here the experiment is for the best illumination of a barrack-room 40 ft. by 20 ft. at a height of 2 feet from the floor. Leaving aside the flat-flame burners, the following are the results:—

Name of Burner.	Total Gas Consumption per Hour.	Illumination.
Siemens regenerative	11·0 cubic feet	Whole room well illuminated.
Deimel regenerative	9·0 „	Two-thirds of working space efficiently lighted.
Two Schulke lamps	10·0 „	Practically whole working space illuminated.
Welsbach incandescent, with glazed conical reflector	4·3 „	Whole room brilliantly lighted.

From this it is evident that the Welsbach gave the best effect, as "brilliantly" lighted evidently argues an increase of illumination over "efficiently" or "well" lighted. At the same time, it must be remarked that the Welsbach consumes less than half the amount of gas of the other systems.

As to Professor Lewes's recommendation of the use of "Sunlight" mantles, which he says may be effectively employed, it is a pity he does not give the results of some actual tests, both as to lighting power and duration.

He arrives finally at the conclusion that flat-flame burners are the most useful for bedrooms, as they afford convenience for heating curling-irons. This savours somewhat of "damning with faint praise" that form of burner which he previously put forward as the one best adapted for use with chandeliers. But, even for the purpose of heating curling-tongs, I would suggest that a flat-flame burner, with the ordinary globe, is scarcely as convenient, and certainly is not in such general use, as the spirit-lamp made for the special purpose of heating. While on the subject of the flat-flame burners, Professor Lewes makes no mention as to whether the illuminating results he has obtained with them were obtained at right angles to the plane of the flame.

As to Professor Lewes's subsequent remarks with respect to the higher actinic value of the Welsbach rays as compared with those obtained by the "Sunlight" mantles, surely the obvious answer is that the results obtained generally from the Welsbach are superior to those of the "Sunlight." But I would go a little farther. Are not the actinic rays of the sun immeasurably greater than those of a Welsbach burner? and is the eyesight affected by being in the open air in a sunny climate? I was under the impression that people who were much in the open air had better eyesight than those who were not; but in this I may be mistaken. At any rate, people are not in the habit of passing their time in staring either at the sun or at Welsbach burners; and though I have no scientific knowledge on the subject, I would say that a well-diffused, steady light is better for the eyes than an inefficient and flickering one.

L. de Fonblanque, Secretary,
Incandescent Gas-Light Company, Limited.

Palmer Street, S.W., Dec. 11, 1896.

The Advantage of Offering New Stock to Gas Consumers.

Sir,—It may interest some of your readers to know that the whole of the new stock offered to the consumers of the Crystal Palace District Gas Company at the beginning of last week has already been more than applied for. As required by the Act of Parliament, £20,000 of stock was advertised for sale by tender, at a minimum price of 135 per cent.; the dividend to begin to accrue from the 1st of January next. This was perhaps a trifle under the market price; the last sales being at about £138, with three or four months' accrued dividend—say £1 10s. But only £250 was applied for, at prices averaging £137. I confess I had some fear whether, with uncertainty in the Money Market, so much stock could be placed in a constituency limited to the consumers of a suburb of London at a price that would pay less than 4 per cent. to the investor. The month of December was given in which to make application, consequently we must wait until the end of the month before the total applications can be made known, which, with your permission, I shall have pleasure in doing.

This, however, is not my main object in writing, but simply my text for urging upon gas companies generally the necessity and the advantage, and the *possibility*, of making friends among the consumers. No man who thinks can deny the necessity or the advantage of so doing; while the facts I now give—following and confirming the experience of the South Metropolitan Gas Company in the same direction—prove the possibility. Objection has been made to increasing the number of small shareholders; but when they are consumers, the greater the number the better. We therefore usually, when offering stock in this way, limit the amount any individual can obtain, in order to spread it over as large a number as possible.

I feel like one "crying in the wilderness," for no one appears to listen when I urge the advisability of making friends of consumers and employees by inducing them to become personally and pecuniarily interested in the Company. At any rate, if any listen, none imitate. But certain as I am, without the least shadow of doubt or hesitation, that the policy is right and worthy of adoption, I again recommend it to the Boards and Managers of Gas Companies.

I fear the tendency is increasing to sell Provincial auction stock in London. I could easily give instances of the injurious results of this practice; and of the neglect to cultivate friends among the consumers of gas. I forbear, however, and content myself with mentioning that the Croydon Gas Company, though so near to London, sell their new stock locally with success. But even they have not gone so far as to offer it to the consumers. I must, however, in justice add that I do not think it is authorized by their Act. It was not authorized by the South Metropolitan Company's Act; but they did it notwithstanding—with the approval of all the parties interested.

George Livesey.

Dec. 12, 1896.

Motor Carriages.

Sir,—The "Engineer" of the 4th inst. has a long extract from the "Journal of Gas Lighting" on the above subject; and as I have had some little experience with a steam carriage and a petroleum car (the latter having been so arranged that it could be worked with either heavy or light oils by substituting a carburettor for the vaporizer), I hope you will find space for this letter.

In my opinion, there is a considerable field for gas-propelled vehicles, especially in towns. If the gas companies were as energetic and pushing as the electrical engineers, the matter would have been brought before the public ere this. Gas is so easily compressed into cylinders for various purposes—for the optical lantern and for balloons—and moreover will remain in the cylinders for months with but little loss, that there should not be the slightest difficulty in adapting it to vehicular traffic. I am not aware what is the actual weight of a 60-feet cylinder; but it cannot be much more than 28 lbs. or 30 lbs. A 120-feet cylinder would therefore weigh about 40 lbs. or 50 lbs., and would contain sufficient gas to drive a light car with two passengers at full speed for three hours, when the empty cylinder would be replaced by a full one quite as quickly as accumulators could be changed. The weight of the gas cylinder would be considerably less than that of accumulators; but though the gas-engine would be heavier than the electro-motor, there would be a considerable saving in weight as compared with an electrical carriage.

To put gas-motor carriages into use, all that is required is for each gas-works to erect a compressor, the cost of which would be small as compared with the cost of electric light plant. The cylinders holding the gas would, of course, be interchangeable. For town use, and even for country touring, when a cylinder of gas can be obtained in any town, I think the gas-engine would hold its own against electricity, or against the somewhat risky spirit petroleum.

J. H. Knight.

Farnham, Dec. 5, 1896.

Choked Ascension-Pipes.

Referring to the letter of a "Country Manager" on the above subject in our issue for the 1st inst., M. Irminger, of Copenhagen, calls attention to one by himself in the number for Feb. 18, 1896 (p. 340), and asks our provincial correspondent to try the remedy therein proposed, and communicate the result to the "Journal."

The Portsea Island Gas Company to be Summoned for Supplying Gas of Deficient Illuminating Power.—At last Tuesday's meeting of the Portsmouth Town Council, it was resolved to prosecute the Portsea Island Gas Company for having supplied gas below the legal illuminating power. A letter was read from Sir John Baker, the Chairman of the Company, stating that the policy of the Directors was to supply gas of 15-candle power instead of the legal 14 candles, and that the tests of the Corporation and the Company differed. Notwithstanding this letter, the resolution to prosecute was carried by 14 votes to 10.

Fatal Gas Explosion.—Last Thursday, Mr. John Milner (aged 82), of Ray Cottage, Heanor, succumbed to injuries which he received in a gas explosion at his house on the 17th ult. On the evening of that date, it was noticed that there was a smell of gas in the house; and on Mr. Milner, his housekeeper, and a domestic (who held a lighted candle) entering the drawing-room) the explosion occurred. All three were severely injured; and the house was completely wrecked. At the inquest, the jury's verdict was that deceased met his death from internal injuries sustained by an accidental explosion of gas, caused by searching for an escape of gas with a naked light.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, Dec. 8.

(*Before Mr. Justice* KEKEWICH.)

Incandescent Gas-Light Company, Limited, v. New Incandescent (Sunlight Patent) Gas Lighting Company, Limited.

Mr. WALTER, on behalf of the plaintiffs, applied *ex parte* for an injunction restraining the defendants from issuing advertisements in which they stated they were the owners of the Rawson process for stiffening mantles for transport, and that an action against the Welsbach Company for infringement of the patent would shortly be heard, which, they were advised, would establish the validity of the patent, and render all users of their mantles liable to proceedings at law, and all stocks of such mantles liable to be destroyed by order of the Court. He said defendants were not the owners of Rawson's patent, nor had they commenced an action; they were merely gratuitously advertising the fact of an action having been brought by some other person.

Justice KEKEWICH thought the advertisement a very improper one; and he granted an interim injunction extending over Friday. He also gave leave to serve notice of motion for that day.

Incandescent Gas-Light Company, Limited, v. Sunlight Incandescent Gas-Lamp Company, Limited.

Mr. WALTER applied for an *ex parte* injunction restraining the defendants from issuing a circular threatening persons with legal proceedings if they continued to sell plaintiffs' mantles, which were said to be stiffened by a process described in the Rawson patent. He said the defendants in this case had commenced an action against the Incandescent Gas-Light Company, and had issued the circular complained of to every agent of the Company; the result being that numerous letters had been received from agents refusing to take mantles or to keep any stock. This, of course, was doing the plaintiffs' business serious injury. The defendants' patent of 1886 had never been sued upon; and it was believed to be absolutely worthless.

Justice KEKEWICH granted the injunction over Friday, and gave leave to serve notice of motion for that day.

Friday, Dec. 11.

On the above matters coming again before his Lordship to-day,

Mr. WALTER stated that, by consent, the motions would stand over till Friday next; and, without prejudice to the rights of the parties in any way, the defendants consented to the interim injunction being continued till that day.

(*Before Mr. Justice* CHITTY.)

Incandescent Gas-Light Company, Limited, v. Mathers.

This was a motion for an injunction to restrain the defendant from infringing the plaintiffs' patent.

Mr. MOULTON, Q.C., said the plaintiffs' patent had been established by the Courts; and he had evidence proving that the defendant had sold mantles which were a direct infringement.

Defendant, who appeared in person, said he had no money to defend the action. He did not wish to put in any evidence in opposition. He had sold the mantles under the following guarantee, which he produced: "Morning Sunlight Incandescent Gas-Lamp Company.—We guarantee our apparatus to be entirely free from infringement, and that our mantles are made of a totally different substance to any others in the market. We also hold you harmless for selling our lights and mantles."

Justice CHITTY: According to this, you may be indemnified.

Mr. MOULTON: This is the way in which the infringements are sold. They get them over from Germany, and sell them to people like the present defendant with a guarantee of that kind—a guarantee which is absolutely false.

Justice CHITTY: It is a good guarantee, apparently.

Mr. MOULTON: It is a guarantee that the mantles are made of a totally different substance from any in the market; and yet, on analysis, we find they contain 98 per cent. of thorium oxide, which is the subject of the plaintiffs' patent of 1886.

Justice CHITTY: The guarantee is a good one.

Mr. MOULTON: I hope it will be a very effective guarantee.

Justice CHITTY: I cannot now go into the question of the guarantee. The defendant may have a case against the Morning Sunlight Company. I notice it is not a limited Company.

Mr. MOULTON: It is probably one person.

Justice CHITTY: I have no option but to grant the injunction.

Defendant: I have not sold any since I had the notice.

By consent of the defendant, the motion was treated as the trial of the action.

His LORDSHIP granted a perpetual injunction, with costs.

Incandescent Gas-Light Company, Limited, v. Edwards.

This was a motion similar in many respects to the former one; and, there being no appearance on behalf of the defendant (Mr. G. Edwards, of 11, Kingsland Road), his Lordship granted an injunction restraining the infringement of the plaintiffs' patent.

(*Before Mr. Justice* KEKEWICH.)

Incandescent Gas-Light Company, Limited, v. Altmann.

Mr. MOULTON, Q.C. (with him Mr. TERRELL, Q.C., and Mr. WALTER) moved for an injunction restraining the defendant from infringing the plaintiffs' patents.

Mr. EUSTACE SMITH, in reply to his Lordship, said the defendant denied infringement. He was only a shopman, and had sold some incandescent mantles which had been manufactured under another patent altogether.

Justice KEKEWICH asked whether the defendant intended at the trial to deny infringement.

Mr. SMITH replied that he did.

Mr. MOULTON said he could show that it was the very thing which had been decided to be an infringement. The real defence appeared to be this: "I am a shopman and sold, and you are going against my master." But it was found there was a peculiar transmogrification of man into master and master into man as plaintiffs took proceedings.

Mr. SMITH: Here you attack master, man, and another man.

Mr. MOULTON said they were all three in the same house, and sold; and there was no agency in *tort*. The plaintiffs bought from Altmann; and they wanted an injunction against him.

Justice KEKEWICH: You are going against the wrongdoer.

Mr. MOULTON said that was so. He proved by evidence the purchase of two dozen infringing mantles, on the 23rd of November, from the defendant, at 33, Jewry Street. On analysis, they were found to contain 97 per cent. of oxide of thorium, and 1¾ per cent. of oxide of cerium; so that it was almost pure oxides of the rare earths.

Justice KEKEWICH asked what was the defence.

Mr. MOULTON said the defendant did not deny selling, but said the mantles sold by Boehr were made in accordance with Kortwich's specification, and did not infringe the plaintiffs' patents.

Mr. SMITH said his learned friend had not read the affidavit on which he relied. Mr. Boehr had sworn that the mantles he sold came from Germany; that he simply had them burnt off after they arrived in England; that the manufacturing business was not carried on at 33, Jewry Street; and that the mantles did not infringe plaintiffs' patents—being made in accordance with Kortwich's patent, No. 2000 of 1896. The plaintiffs' analyst only spoke as to opinion; and this was met by the defendant denying that the mantles were made in accordance with plaintiffs' patents. He thought they ought to have an opportunity of having the mantles analyzed.

Justice KEKEWICH: You are entitled to have it thrashed out at the trial. The only question is whether you are to go on selling in the meantime.

Mr. SMITH said the defendant's evidence was clear and uncontradicted that the mantles were not manufactured according to the plaintiffs' patents. The plaintiffs did not suggest that Kortwich's patent had been attacked, or that it was invalid.

Justice KEKEWICH granted an injunction until the trial of the action; restraining the infringement of the plaintiffs' patents.

Saturday, Nov. 12.

(*Before Mr. Justice* STIRLING.)

Incandescent Gas-Light Company, Limited, v. Sarkeini.

This action came on as a short cause on a motion for judgment in default of defence. The case was of the usual nature; the allegation being that defendant had infringed the plaintiffs' patents of 1885, 1886, and 1893. The plaintiffs asked for an account of profits, delivery of the infringing mantles, and costs as between solicitor and client; and his Lordship made the order as prayed.

Monday, Dec. 14.

(*Before Mr. Justice* ROMER.)

In re the Meteor Incandescent Lighting Company, Limited.

A creditor's petition, presented by John Day and Co., Limited, for the compulsory winding up of this Company, came before his Lordship, sitting for Mr. Justice Vaughan Williams.

Mr. FORD stated that the petition was unopposed, no one having taken a copy. Since the presentation of the petition, resolutions had been passed for voluntary liquidation, and the Company were agreeable that the winding up should be continued under the supervision of the Court. The petitioners were willing to accept a supervision order.

His LORDSHIP ordered the petiton to stand over, and gave leave to amend by asking, in the alternative, for a supervision order. He also directed that the petition should be advertised again.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, Dec. 9.

(*Before Justices* WILLS *and* WRIGHT.)

Corporation of Southport v. Birkdale Urban District Council.

This was an appeal (on a case stated by Magistrates) against a conviction for supplying gas of less than 20-candle illuminating power (see "JOURNAL" for June 30 last, p. 1477).

Mr. FLETCHER MOULTON, Q.C., Mr. FREEMAN, Q.C., and Mr. S. T. EVANS, M.P., appeared for the appellants; Mr. HORRIDGE represented the respondents.

The case occupied a considerable time in argument; but the point was in reality reduced to the question of the meaning to be attached to the words "or other approved burner," in section 35 of the Southport Improvement Act, 1871, under powers of which the Corporation manufacture and supply gas to Southport and certain adjoining districts, including Birkdale. By section 35, the Corporation (as successors to the Improvement Commissioners, who obtained the Act) are to provide gas of such illuminating power as to produce, with an argand burner having 15 holes and a 7-inch chimney, or "other approved burner" consuming 5 cubic feet per hour, a light equal to 20 candles. The Magistrates held that in the absence of any burner which complied with the term "approved burner," the test had been properly conducted with the argand 15-hole burner prescribed by the section. They allowed evidence as to the materials used for the manufacture of the gas; but as it was admitted that when tested with the 15-hole argand it would not comply with the section, they excluded evidence as to tests by other burners, or the results of analyses. They found that the argand

with 15 holes was the burner intended by the Act of Parliament, in the absence of any proof of an agreement as to any other burner being approved between the parties.

Mr. MOULTON argued that the word "approved" in the section must have some meaning assigned to it; that it could not mean agreed on by the parties, as in a case like the one before the Court this would involve an agreement with every individual consumer; and that the meaning must therefore be a suitable and proper burner, such as would be approved by persons skilled in these matters.

Mr HORRIDGE, for the respondents, submitted that when the Act was passed, the intention was that gas should be supplied at a specified price, which would show the illuminating power prescribed when tested by the 15-hole argand; and it was never contemplated that, through continued improvements in burners, by which the illuminating power was increased, the appellants were entitled to correspondingly decrease the quality of the article supplied, and still claim to be fulfilling the condition of the section. In reply to the Court, he admitted that, in effect, he should strike the word "approved" out of the section.

Mr. FREEMAN having briefly replied,

Justice WILLS, in giving judgment, said this case was one of considerable difficulty—a difficulty which always occurred when words had been used in an Act of Parliament apparently without much consideration of what they meant. One could not help thinking that in all probability this word "approved," which created all the trouble, had found its way into the Act of Parliament because it was originally intended by the draughtsman that there should be some proper authority to approve, and that the portion of the original draft somehow or other got dropped out of the Act. But however interesting that might be as a speculation as to how the difficulty arose, it was obviously a consideration which must be excluded from the interpretation of the Act. It seemed to him to be required by all the usual principles upon which statutes were construed, that he must assume that the legislature meant something by the language which was used. Mr. Horridge's argument was very able and clear; but it seemed to him to drive one almost inevitably to the conclusion, if he were right, that the words "other approved burner" must be struck out of the Act, on the ground that it was impossible to give any meaning to the word "approved." If it were impossible to do so, that would be the right way of construing it. But obviously such a view could only be adopted in the very last resort. He thought it was possible to give a meaning to the word; and, if so, he ought to do so. Section 35 was a general section, which applied to the whole of the community to be supplied with gas by the Southport Improvement Commissioners or Local Board; it was not a section intended to have any special operation as between the Southport Commissioners and the Local Board of Birkdale. It was impossible, therefore, to read it with respect to any relation subsisting or contemplated between these bodies; and so it could not be said that "approved" meant approved by both parties, as might have been held if the section were one *inter partes*, so to speak. Still less could it be said that it meant approved by the Corporation who were making the gas. One must, therefore, seek for some other meaning; and the only remaining one possible seemed to be that it was to be some burner which had received a general concensus of approval as a fair means of measuring the quality of the gas supplied, between the persons making it and the persons who had to take it, without reference to any standard imposed by other Acts of Parliament. Certainly it would not be very difficult to apply such a test as this. He thought it might further be said that it ought, looking to the nature of the Act and the section, to be some fair equivalent with the reference to all the circumstances of the case of the 15-hole argand burner with 7-inch chimney known at the time when the Act was passed, and consuming 5 feet of gas per hour. He should think probably, within the last 25 years, great changes had taken place in the manufacture of gas, and in the burners in common use; and that the conditions which would be applied now by anybody who had to fix the standard for testing 20-candle power, would most likely be very different to what they would have been in 1871. It seemed to him that, if you could get a burner testing with which would secure that the purchaser had as good value for his money in illuminating power as he would have got in 1871 by the use of the particular standard then mentioned, the Act would be complied with. This seemed to be a reasonable construction to put upon the words—at all events, he could see no better, and he had in vain attempted to get anything better from the learned Counsel either on the one side or on the other. He could not be assisted by Mr. Horridge's view, which amounted to expunging part of the Act altogether; and from the learned Counsel who so ably represented the other side, he had not obtained any better suggestion than the one he had adopted himself as to the meaning of section 35. Once having got to the meaning of the section, it became perfectly easy to see what was intended by section 38. It seemed to say that section 35 must be complied with by apparatus being put up within six months; and that such apparatus should thereafter be maintained so as to satisfy section 35. If this were once done, it seemed to follow that what Birkdale was to fit up as its test at the other end, within its own jurisdiction, must be the same; and that the only sensible meaning to give to the words "like testing-meter," was that it was to be a meter of the same character and quality, because otherwise you would be applying two different tests, and there would be endless confusion. The Birkdale Local Board got this incidental advantage by fitting up their own testing-meter—that the Corporation which supplied the gas, had to run the risk of leakage, loss of pressure, and so on, caused by driving the gas through a certain number of yards or miles of mains; and to this advantage the Birkdale people were clearly entitled. They were entitled to have the gas tested at their own station; and if it did not come up to the standard there, it was no answer to say it was good enough when it left the Corporation works, but something had been lost on the way. He was fully alive to the importance of the question; but he feared that this being a criminal matter, there was no power of carrying it further. It followed that the Birkdale people, not having put up a like testing apparatus in the sense of being identical with the other, the conditions necessary to establish the offence had not been fulfilled; and the appeal would therefore succeed with costs.

Justice WRIGHT said he agreed entirely; but he was not quite satisfied that it was a criminal matter. The form of the enactment did not refer to a conviction at all, but only said the Corporation should forfeit such sum as the Justices should determine to be paid to the Local Board. It might be found that there was a right of appeal.

Mr. HORRIDGE said he thought there was; and he was going to ask their Lordships to give leave to appeal, if it were necessary.

Justice WILLS said leave would be given if it were found to be an appealable case.

The Charge of Embezzlement against a Collector.

At the Westminster Police Court, last Tuesday, Henry John Prosser, of Alderville Road, Fulham, lately a collector in the service of The Gaslight and Coke Company, was charged, on remand, with embezzlement and falsification of accounts (see *ante*, p. 1139). The case for the prosecution was that the defendant had falsified his accounts for some months, and that he had not paid into the bank at the time of collection various moneys he had received. There was a large deficiency the day before his arrest; but it was suggested that a friendly intimation reached him while the police were looking for him, and this enabled him to get assistance, and so to put his cash right at the last moment. On the 30th ult., defendant borrowed £50, for "a few hours," from a licensed victualler (and he had been similarly accommodated before) to make up his accounts. There was no money now owing to the Company. The defendant had been collecting for 14 years; receiving, on an average, about £8000 a quarter for the Company. He was further remanded.

A Bogus Gas Collector.

At the Stockton Borough Police Court last Wednesday, Wm. Bromley (aged 20) was fined 21s. for the theft of a watch from his lodgings in Balaclava Street on the 2nd inst.; and later in the day, at the County Police Court, he was brought up on a charge of false pretences on the same date. It appeared that, after decamping with the watch, the prisoner went to Captain Green's house at Billingham, and representing himself as the Assistant Gas Manager of the Stockton Corporation, examined the meter. He said a certain quantity of gas had been consumed, and he required 7s. 6d. Miss Green, thinking it was all right, paid him, and obtained a receipt. Prisoner (who was apprehended at Newcastle Barracks when on the point of enlisting) was committed for trial.

Embezzlement by a Gas Collector.

At the Reading Borough Police Court, on the 28th ult., Albert Batten, a clerk in the service of the Reading Gas Company, was charged with embezzling £8 18s., £5 5s. 11d., and £5, the moneys of his employers, between June 1 and Aug. 11. The accused had surrendered himself, and expressed sorrow for what he had done. A remand was granted; bail being accepted. On the further hearing of the case, it was proved that the amounts in question had not been accounted for. The prisoner pleaded guilty, and was sentenced to three months' hard labour for each offence—the sentences to run concurrently.

The Cost of Softening the St. Helens Water Supply.—The Corporation Water Engineer of St. Helens reports that the cost of the new water-softening process in 1894-5, including £392 for sinking fund, was £1716; and in 1895-6, it was £1862, including £436 for the sinking fund. In 1894-5, 607,800,000 gallons of water were softened; and in 1895-6, 630,000,000 gallons. The original estimate of the cost was §d. per 1000 gallons; and the actual cost is as near that as possible.

East Grinstead Gas and Water Works.—The East Grinstead District Council have opened negotiations with the Directors of the Gas and Water Company for the sale of their undertaking. The wording of a communication from the Directors, which was read at the last meeting of the Council, conveys the impression that the latter have only been seeking to purchase "a part" of the undertaking; and for the sale of a part, the Directors are not prepared to treat. The Council have, however, now decided to continue negotiations for the transfer of the whole concern.

Incandescent Gas Lighting and Oil Gas Enrichment at Bradford.—Among the minutes submitted by the Gas and Electricity Committee at last week's meeting of the Bradford Town Council, was one instructing the Gas Engineer to fit up the whole of the Bray lamps in the borough with incandescent gas-burners. The cost of making the change, the Mayor (Mr. T. Speight) stated, would be £1 os. 6d. per lamp, which, for 650 lamps, would work out to about £670. Replying to Alderman Priestman, who wished to know if the Committee had determined to abandon the use of oil for the purpose of enrichment, the Mayor remarked that the subject of oil gas had certainly not been "burning" for over thirteen months. The members of the Gas Committee would agree with him that he had several times wished to bring the matter up, but had received the reply, "Please let us be quiet; we are so happy." (Laughter.) He was quite willing at any moment, if the Committee wished, to discuss this question and thrash it out. The minutes were adopted.

Projected Improvements at the Sandwich Gas-Works.—At a meeting of the Sandwich Town Council last Wednesday, the Mayor stated that the Gas Committee had considered the question of erecting entirely new works at a cost of between £5000 and £6000; but, after taking various things into account, they had thought it best to put the present works in good order, at a cost of about £1400. They therefore proposed that the plant should be augmented by the addition of a condenser, three purifiers, an 8-inch pipe to the gasholder, a governor, and a gasholder. It was not intended to put up the new holder at once; but there was no doubt it would have to be done in the course of the next twelve months. A new station meter would also be necessary, so far as they could see; but they intended to have the advice of an expert on this point. The Committee recommended the Council to apply to the Local Government Board for power to borrow £8000 in connection with the contemplated improvements; and it was resolved to hold a special meeting to consider the matter.

MISCELLANEOUS NEWS.

SOUTHPORT CORPORATION GAS SUPPLY.

The Proposed Reduction in the Illuminating Power and Price of Gas.

As briefly noticed in the "JOURNAL" last week, the Southport Town Council, at a special meeting held on the 30th ult., unanimously decided to apply to the Local Government Board for a Provisional Order to repeal, alter, or amend the Southport Improvement Acts, 1871 and 1876, in respect of the following matters: (1) The illuminating power of the gas to be supplied under the Act; (2) the method of testing such illuminating power; and (3) the maximum price to be charged.

The matter was introduced by Mr. Dimond, who, in moving the necessary resolution, stated that the question had been before the Gas Committee for some time, apart from anything that had arisen or might arise in Birkdale. According to statements of authorities in the gas profession, 16-candle gas was quite sufficient for purposes of lighting. Their Town Clerk had obtained returns from 88 Corporations who were manufacturing and supplying gas which was satisfactory between 14 and 16 candle power. Professor Vivian B. Lewes had drawn attention to the extravagant waste of money in enriching their gas to 20-candle power, when equally good light for all purposes could be produced by 16-candle gas manufactured from ordinary coal. London gas was only 16-candle power. With regard to the second matter, it was proposed to ask the Local Government Board to allow them to test the illuminating power of the gas with the "London" argand burner. With regard to the maximum charge, they purposed asking that it should be reduced to 3s. 9d. per 1000 cubic feet; and he thought they would be able to supply a good gas at the lower price. Alderman Fisher, in seconding the motion, said the Gas Committee had been conscious for some time that the cost of the cannel or oil used to enrich the gas had been very great, and not at all in accordance with the relative value received. Virtually, as had been said by an expert, it was like putting in a sovereign and getting a shilling. This was not working exactly on commercial lines. By obtaining a Provisional Order, they hoped to end the difficulty which had arisen with their neighbours at Birkdale. Mr. Eastwood said he should like to have some information as to the value of 16-candle as against 20-candle gas for heating purposes; because the gas used in this way was an increasing quantity. Dr. Isherwood explained that with gas of low illuminating power, as great an amount of heat would be afforded as by gas of higher quality. A point which had occupied his attention a great deal had, he said, been the cost of raising the light-giving property of gas; and it had occurred to him whether they did not spend just the same amount on increasing the lighting power from 15 to 20 candles as they did in bringing it up from 10 to 15 candles. To enrich gas beyond the latter standard, expensive materials had to be employed; and it was to obviate the use of these to a great extent that they wished to supply gas of lower power. Moreover, the majority of burners were suited for this quality of gas, and would not satisfactorily consume it if of 20-candle power. Mr. Boocock asked if the effect of lowering the illuminating power would be to increase the smoke resulting from the combustion of the gas. The Town Clerk (Mr. J. D. Williams) replied that, on the contrary, it would more probably reduce it. Mr. Irving asked whether, if the quality of the gas were reduced from 20 to 16 candles, it would, with the burners which the consumers used now, be equal to the present illuminant, or anything approaching it. Alderman Griffiths said the question was an important one to the ratepayers. If they used the burners they had now, the light from 16-candle gas would be about equal to that obtained from 20-candle gas. The Corporation were making gas with a very large quantity of carbon in its composition; and when they put on a burner which would only burn 14-candle gas (for it was a fact that in nineteen out of every twenty burners in Southport the light obtained was one of 14 candles), the light of the other 6 candles was going somewhere. It was really going through the burner in the form of unconsumed carbon; and, of course, this carbon became a deposit. In the case of a gas which the burner entirely consumed, there was naturally less deposit. Therefore the public were paying for a high illuminating power of gas, and using a burner unsuitable for its consumption. The Corporation were anxious to give the ratepayers a gas of which 90 or 95 per cent. would be consumed when it passed through the burners. It was therefore proposed to have a 15-candle standard for Southport; and he was convinced that the Corporation would be putting thousands of pounds annually into the pockets of the gas consumers if they were allowed to carry out their project. With regard to cooking and heating, there was no doubt that 14-candle gas was better for these purposes than gas of higher lighting power. Mr. Holland said it seemed to him paradoxical to go from 20 to 15 candle gas to get a better light. However, he was willing to agree to anything whereby the gas might be improved, as it needed it at times. The Town Clerk at this point read some returns he had received as to the illuminating power of the gas supplied by companies in England and Wales. They showed that 4 companies supplied 12-candle gas; 44 companies, 14-candle; 21 companies, 15-candle; 13 companies, 16-candle; 4 companies, 18-candle; and 2 companies, 20-candle. Mr. Hulme supported the resolution, because he thought the Corporation were about to proceed on business lines. He pointed out that, in the statement read by the Town Clerk, there were only six companies making gas of more than 16-candle power. He also believed that, with the growth of the use of gas for cooking and heating purposes, the lower illuminating power would be of very great advantage, not only so far as its heating properties were concerned, but also in regard to its price. Mr. Hesford thought the maximum proposed—3s. 9d. per 1000 cubic feet—was too high. Mr. Dimond remarked that, on the contrary, there was none so low. Mr. Travis expressed the hope that the Gas Committee would never have occasion to charge the maximum. The question was what price the Committee could afford to sell gas at if the reduction was obtained. He thought that they should have 6d. per 1000 cubic feet off at once, and that the price should not exceed 2s. 6d. Then they could offer to the Birkdale people gas in bulk at 2s. 6d. per 1000 feet, less 5 per cent., and they could do what they liked with it. Alderman Nicholson thought the Committee had proved their case; but he asked why the matter had not been brought forward sooner. Alderman Rimmer said they might be late; but "better late than never." He said he should like to disabuse Mr. Holland's mind on one point. The Committee had never stated that 14-candle gas would be as good as that they were now supplying; but they said most emphatically that they had no burner in use in Southport at the present time suitable for burning the 22-candle gas they supplied. Mr. Dimond having briefly replied, the resolution was put to the vote, and carried unanimously.

The matter was still further discussed at the meeting of the Town Council last Tuesday. Mr. Dimond, in moving the adoption of the minutes of the Gas Committee, mentioned that he had taken upon himself the responsibility of writing to the Chairman of the Birkdale Gas Committee to explain matters which did not appear to be quite understood by them; and he expected the letter would be discussed at the next meeting of the Committee. With regard to the question of supplying to Birkdale gas of a lower illuminating power, he wished to state that the Southport Gas Committee were prepared to give them, if they required it, a separate main, by means of which they could obtain a supply which they considered satisfactory. He hoped at the next meeting to be able to say that matters had been adjusted between the two authorities, and that Birkdale had benefited by the result. Dr. Wood seconded the motion. Dr. Weaver said it seemed a curious thing for the Gas Committee to say they were now supplying gas of 20-candle power, but that 16-candle gas would give as good or even better light. If this was the fact, the question of gas testing was something in the nature of a fraud. The gas might be of the right power when it left the works; but the consumers complained that they were not receiving the full benefit of it. The gas certainly did not go into the houses or shops equal to 20-candle power. The ratepayers had never asked for cheaper gas. They wanted it of better quality. In Birkdale, they were unanimous as to the wretched character of the gas; and he believed that the majority of the people of Southport were of the same opinion. Alderman Griffiths, replying to Dr. Weaver's remarks, said, with regard to the quality of the gas, the Committee had the best instruments they could buy for testing it; and it was not fair for members of the Council to speak as though they were not making 20-candle gas. As a matter of fact, at the present time the gas as produced was of 22-candle power; and calculations showed that it lost from 1 to 1½ candle power in its transit to Birkdale. The Committee did not say that, according to their way of measuring, they were delivering into the houses of Southport 20-candle gas; but they did say that they were giving the best possible results. Mr. Broadbent thought the Committee were doing an exceedingly wise thing in reducing the illuminating power; and he doubted whether the public would find very much difference. Mr. Holland reiterated his opinion that the whole thing was a paradox—an opinion which he said had been strengthened by what had taken place at this meeting. Dr. Wood said that if the Corporation could reduce the quality of the gas to 16-candle power and supply freely to the consumers burners which would give a good light, and the gas bills were considerably reduced, he was sure the householders of Southport would be delighted. He thought this was what should be done, if possible, owing to the action of Birkdale. Alderman Fisher said he believed they were acting in the best interests of the town in proposing to supply gas of lower illuminating power. If they raised the quality as required by Birkdale, it would increase their expenditure by £8000 or £10,000 a year. Under these circumstances, it would be better to cut Birkdale off altogether; but he did not wish to do this. They had a mutual interest in keeping up the supply; and he thought by lowering the standard they would be able to do a good turn to the Birkdale consumers as well as to themselves. Mr. Irving thought the Committee were making a move in the right direction by trying to lower the standard of the gas; and he said he only regretted they had not done it years ago. It might have saved many thousands of pounds. What they proposed to do would effect a saving in the cost of the gas as well as an improvement in the light. They were trying to benefit the gas consumers of both places; and he hoped the Birkdale people would be able to look at the matter from this point of view. Mr. Dimond, in reply, pointed out that for the past twenty years no application had been made to fix the standard of illuminating power of gas at 20 candles. He assured the Council that the Committee wished to give the consumers in Birkdale a share of the benefits they enjoyed themselves. The minutes were then passed.

Birkdale's Views on the Question.

The subject of the discussions epitomized above came before the Birkdale District Council at their meeting on the 1st inst., in the minutes presented by the Lighting Committee. According to what transpired, arrangements had been made for a deputation from the Southport Corporation to meet the Committee; and, after the interview, there appeared to be every prospect of a settlement of the differences between the two bodies being arrived at. However, before the District Council had had time to fully consider the matter, the Corporation notified their intention of applying for a Provisional Order to amend their Acts of 1871 and 1876, which proceeding will give the Council an opportunity of stating their side of the question. It is contended that the Council are not "cantankerous," as they have been charged with being by a member of the Corporation. All they want is, they say, that they and the gas consumers shall get what they are justly entitled to; and it is thought that, if the Corporation really wish to arrive at a settlement of the gas question, they have taken rather peculiar steps to attain this end. The Chairman of the Council (Mr. T. O. Clinning) made a few remarks as to the way in which the question had been treated by the Corporation. He stated that ever since 1876 the consumers of gas in Birkdale had undoubtedly been getting less illuminating power than they ought to have done. Consequently, as they had been paying for a proper quality of gas, the result had been a considerable loss to them. He was amazed, considering the time the Council had allowed the matter to stand over—when the price

of coal was high, and when the long frost was in progress—that the Corporation should ask them to let bygones be bygones, and settle the matter. The Council had nothing to settle. On the other hand, they had been doing their best to meet the Corporation in a reasonable way; and what did the latter offer them? They said that, for the sake of economy, they must reduce the candle power of the gas; and this cut the question from under the Council's feet. Their Act of Parliament said they must supply 20-candle gas, measured by a 15-hole argand burner; and this could not be altered until the legal question was settled by the appeal.* What the Council wanted was to get a proper quality of gas for the money paid for it; and not all the argument in the world could alter that. It could not be construed in any other way than as a misapplication of justice; and justice, he thought, they were now fairly entitled to in the interests of public lighting and of private consumers. As to the enrichment of the gas, they talked about oil costing so much more than other enriching materials. They forgot that they could produce 20-candle cannel gas with a very much better light at a little more cost. They had been trying to reduce the cost, with the result that in twelve months they had made a profit of £16,000. This meant 1s. 4d. off the rates in Southport; and the Birkdale consumers were really finding Southport at least a reduction of 3d. or 4d. in the rates in the price they paid for gas. As to the question of reducing the maximum, they in Birkdale did not so much mind the price they paid for the gas, so long as they had a good, clear light, which would not do any damage to their property. The gas at present was abominable; and the sooner they showed the Corporation that they were quite equal to undertake the question the better. They had an able and clever man as Engineer; and if they acted upon his advice, the question would very soon be settled.

THE MATLOCK BATH GAS ARBITRATION.

The Award.

Our Derbyshire correspondent writes: Sir William Coddington, Bart., M.P., who was the final Arbitrator to determine the price to be paid by the Matlock Bath and Scarthin Nick Urban District Council to the Matlock Bath Gas Company for their undertaking, has made his award; and in more respects than one it has caused a flutter in the Midland gas world. In the first place, instead of intimating that his award was ready to be taken up, he forwarded it straight away to the Clerk to the Urban District Council (Mr. F. C. Lymn), who had, if he cared, apparently to supply it to the Gas Company, who were quite willing and anxious to take it up in the orthodox manner. Sir William, in the award, recites the provisions of the Act authorizing the purchase of the undertaking; and he then adds: "I award and determine the price or consideration to be paid by the Council to the Company for the purchase of the undertaking of the Company, shall be and is hereby fixed and determined to be the gross sum of £16,726 3s. 9d., which said sum I award and order shall be paid by the Council to the Company on the 1st day of January next; and I further award and order that the Council and the Company shall each bear and pay their own costs of and incident to the said arbitration, and half the costs of this my award, which I hereby fix at the nominal sum of £5 5s." The award is nearly at the rate of 21 years' purchase on the maintainable profits as given by the Company—£801. As will be seen by the report of the proceedings in the "JOURNAL," the maintainable profits as given by the Council were only £496 odd, taking which as a basis the number of years' purchase would be at the rate claimed by the Company's witnesses. But there is nothing in the award to show how the total figure is made up; and when it is fully analyzed it is found that the proprietors will only receive the value of their shares at par. There are £2000 worth of debentures held by Derbyshire gentlemen; and these take priority of all other claims. Then there are the accumulated costs of the Company obtaining their Provisional Order, and fighting through the Houses of Commons and Lords; and I learn upon the best authority that, when all claims have been met, there will be left for division about £10,000, which is the capital of the Company, upon which during the past few years a regular 10 per cent. has been paid. Mr. H. E. Jones, who was called for the Company, claimed that the gross value of the undertaking was £27,269; while Mr. Thomas Newbigging's figure was £25,579, which was the same as that given by Mr. Corbet Woodall. The last two witnesses claimed 26⅔ years' purchase. For the Company Mr. E. H. Stevenson claimed that only £496 17s. 7d. could be maintainable profit, and that a fair multiplier was 18 years. A similar multiplier was used by Mr. W. R. Chester; and it was claimed that £9000 was the total value of the undertaking. The Council claim that this is a victory for them, as they are relieved of paying costs, and the ratepayers of Matlock Bath and Scarthin Nick are naturally jubilant. The proprietors of the Company are, however, not at all pleased.

The Proposed Municipalization of the Maidstone Water-Works.—Last Wednesday, the result of the poll of ratepayers on the question of purchasing the undertaking of the Maidstone Water Company, was made known; the return showing a majority of over 2000 against the project. This large number was quite unexpected; it being thought that the voting would be fairly close. The amount of interest taken in the matter by the ratepayers is shown by the fact that only about two-thirds of those entitled to vote filled up their papers.

The Water-Works Purchase Question at Chichester.—On the result of the recent poll on the subject of the proposed purchase of the Chichester Water-Works being reported to the City Council last Tuesday as being in favour of the purchase, Mr. Mant said he had lodged the following objections with the presiding officer: (1) That a member of the Council was employed in distributing and collecting the voting-papers; (2) that there was no secrecy in the collection of the papers by the provision of ballot-boxes; and (3) that the papers were bad because it was wrongly stated on each that it was agreed at a meeting on Oct. 27 to submit the resolution to the owners and ratepayers of the city.

* The result is reported in our "Legal Intelligence" to-day.—ED. J. G. L.

THE PROPOSED PURCHASE OF THE KINGSTON-ON-HULL GAS-WORKS BY THE CORPORATION.

At the Meeting of the Hull Town Council last Thursday—the MAYOR (Mr. H. Morrill) in the chair—the Committee appointed by the Council to consider the question of purchasing the Kingston-on-Hull Gas Company, reported the result of their inquiries and negotiations, and recommended the purchase of the undertaking for £92,500.

Alderman MASSEY, in moving the confirmation of the minutes, said he might state, at the outset, that there was nothing to conceal in any shape or form; and the time had now arrived for the discussion of the facts. If he could satisfy the Corporation that the purchase of the site of the Kingston Gas Company would put into the hands of the town an area of property of about an acre in extent, free of any cost whatever to the ratepayers; that the operation would give better gas, and reduce the price to the consumers; and further that it would secure for the Corporation, in addition to the freehold property, the key of the position to further absolutely necessary street improvements—he thought there would be no difference of opinion as to the merits or demerits of the scheme. The general impression outside was that the concern was a wreck, and broken down. He found it nothing of the sort. It was generally supposed that the Corporation electric lighting installation had given a very severe blow to the profits of the Company; but, singular to relate, the very contrary was the fact. Ever since the electric light had been introduced, the earnings of the Company had increased from year to year; and if the Corporation were not in a position to extend the installation in the old town, it was unreasonable to suppose that material damage would be inflicted on the gas undertaking as far as the future earnings were concerned. From the year 1882 to 1886, the official returns presented by the Company to the Board of Trade showed that their profits were £3251 per annum; and from 1887 to 1891, the average earnings were £3707 per annum, or an increase of 14 per cent. From 1892 to the beginning of this year, there was a further increase of 8½ per cent.; the average profits being £4036 per annum. Now the profit of the current year had amounted to the sum of £4806—an increase of 12 per cent. over the previous five years' averages. He was further informed by the Accountant of the Company that in looking through the books he had found an increase in the earnings of £300 in the half year ending September last, as compared with the previous half. During all these years, the property had been maintained at a very great expenditure. From 1887 to 1896, the average outlay on the works for repairs, new mains, &c., had averaged from £1280 to £1500 per annum; certainly in no single year had it been less than £1000. The first price put upon their undertaking by the Company was £116,000. This, however, the Committee could not entertain; and they made a bid practically based upon the figures which the Corporation offered for the works some ten or twelve years prior to the improved conditions of to-day. Those figures were £85,000; the proposal at that time falling through without further negotiation. After due consideration, the Committee decided to make the offer of a lump sum of £92,500; and individually he thought this was the best bargain they could make. It would not cost the ratepayers a farthing; and he would show them they were on the right side of the fence. From the official returns, it was seen that during 1895 the Company supplied 92,599,600 cubic feet of gas. If the works were acquired by the Corporation, they would commence to supply the present consumers at 2s. 8d. per 1000 cubic feet, as against the existing charge of 3s. A Gas Company on their frontiers had offered to supply them with the same volume of gas at 1s. 6d. per 1000 cubic feet. He did not say that this would be acceptable, because they might be able to make still better terms. But upon the price offered, they had a margin of 1s. 2d. per 1000 cubic feet for the purpose of paying the interest of 3 per cent. on the loan; and, after the liquidation of all charges, they would have left a clear profit of £809 per annum for the benefit of the rates. They would acquire the land and the works practically for nothing; and it must be remembered that for the scheme, which had for its object the making of a great thoroughfare from Drypool to Whitefriargate, the site of the Company was the key of the position. He strongly urged the acceptance of the terms upon the Corporation.

Alderman RAYMENT seconded the motion, and said, if it were possible, he would like to extend the purchase to the whole of the gas-works in the locality.

Alderman ROLLIT thought the scheme would impose a burden upon the ratepayers in the old town. He was with Mr. Massey on the question of buying the works; but he could not quite see his way to approve the basis.

Mr. C. SHAW said he never remembered a scheme of this magnitude being brought forward upon such crude information. It was unjust to ask them to rush wildly into the question.

Mr. HALL did not think the old town should bear the whole of the burden.

Mr. BELT said he did not believe there was the worth for the money; and he held that the cost should be spread over the whole town.

Sir J. WOODHOUSE, M.P., said this was the first time he had known the Council to be asked to commit themselves to such a large expenditure without having placed before them full details upon which the outlay was recommended; and no decision of the Council would commend itself to the ratepayers unless the latter were put in possession of all particulars. He (Sir James) was heartily in favour of purchasing the Company's works. He had been anxious for years to remove what was a nuisance in their midst, and to procure a supply of gas for the town from another direction. But it resolved itself into a question of terms; and he asked if the Council were satisfied that they had before them the best arrangement by which the works could be acquired.

Mr. GILLETT trusted the scheme would receive the support of the members. It was the only hope the ratepayers in the old town had of getting rid of the Kingston Company.

Several other members spoke for and against the motion; and an amendment was moved referring the question back to the Committee. On a division, the amendment was rejected by 14 votes to 35.

THE LOWESTOFT GAS AND WATER WORKS PURCHASE QUESTION.

At the Meeting of the Lowestoft Town Council last Tuesday, the Deputy-Mayor (Colonel A. G. Lucas) moved—"That a Special Water Committee be authorized to affix the common seal of the Corporation to the petition to Parliament for leave to bring in the Lowestoft Corporation (Water and Gas Works Transfer) Bill." It had been said, he remarked, that the matter had been mooted from pique and spite; but he denied that this was the case. The Committee took it in hand in order that the quality and quantity of the water should be above suspicion. Whatever was the result of the poll, it had done good; for it had stirred up the Water Company to deposit a Bill to enable them to obtain a larger supply. Looking at the financial aspect of the question, he said the capital of the Company was £180,000; and they were paying a dividend of 7½ per cent. This amount stood in ten different issues of stocks; but the stock paying 7½ per cent. was only £25,000. However, that was an average on which they could make a calculation to get at the price. This particular stock had been quoted at £22 10s., which was not an uncommon price when the acquisition of a property was in view. A few shares might possibly be sent up and sold in London at a great deal more than the average price. Perhaps, too, the rise had been influenced by the idea that the business would be so well managed by the Corporation. Anyhow, the price quoted in the Norwich market was £21. Some difficulty had arisen as to how the purchase would be carried out. Having gone into figures, they knew they could issue Corporation stock at 2¾ per cent. The interest would be: On £100,000, £2750 a year; on £200,000, £5500; and on £300,000, £8250. The balance-sheets of the Company showed that the profits had been very considerable, and that there was a large margin between £8250 and the profit they were now receiving. Probably the net income was more than £12,000 a year. Regarding the redemption fund, if this cost ¾ per cent. per annum, they would have a margin to work on; if they acquired the property at a fair value, they would have an immediate margin to work on. Moreover, he had not taken into consideration the Directors' fees, the office charges, or collectors' charges, which would not be incurred under the Corporation. It had been said that to purchase the gas undertaking might retard the introduction of the electric light; but he did not see that this should be the case. Gas would be required more and more for domestic purposes; and if the Corporation acquired the gas-works, there was no reason why they should not have the electric light, and work the two together. They hoped to be in possession of the gas and water works before many months elapsed; and if they did not succeed this time, they would go on pegging away till they did get them. Alderman J. Beckett, in seconding the motion, pointed out that, where the electric light had been introduced, it had not depreciated the value of the gas shares. The motion was carried.

GAS AND WATER WORKS EXTENSIONS AT FALKIRK.

Inauguration Ceremonies.

On Thursday last the Falkirk and District Water Trust inaugurated two new filters which have been constructed at Little Denny, in connection with their undertaking, and which are the first instalment of a scheme of extension that was sanctioned by an Act of Parliament passed last session; and on the same day the Falkirk Gas Commissioners inaugurated a new gasholder which has been erected on the wire-rope guided system patented by Mr. E. L. Pease, of the firm of Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees. The works are fully described in our "Notes from Scotland" this week. There was a large company at both ceremonies, who were afterwards entertained to dinner in the Crown Hotel. Provost WEIR occupied the chair, and Bailie HAMILTON, the Convener of the Works Committee of the Gas Commission, was Croupier. Subsequently,

Mr. J. WATSON, C.E., of Bradford, proposed the toast of "The Falkirk and Larbert Water Trust." He said the history of this important Trust was somewhat important. In 1883, he remembered coming to Falkirk to go into the particularly salubrious place from which they then drew their water, in the shape of an old coal pit. The supply gave the citizens of the town about 150,000 gallons per day, or 6 gallons per day for every man, woman, and child. Now in 1896 they had very excellent gravitation works, from which they were able to obtain a supply, not, perhaps, like the old magnificent supplies of Rome, which deluged the people of the city with water, but they could supply from basement to garret that precious necessary of life to the tune of 40 gallons per head per day. They were now using 1,400,000 gallons per day. Practically their consumption had increased almost ten-fold. He was pleased to hear that, notwithstanding the enormous increase in the demand upon their water supply, they had been able to reduce the water rate by 4½d. per pound; and they were able to supply water for trade and industrial concerns at 4½d. per 1000 gallons. He was sure they all realized something of the functions which devolved on a Trust such as this. He considered that there was no Trust or Corporation that the Parliament of this country had created which had conferred greater benefit on mankind than did a Water Trust.

Provost WEIR, in responding, said that six years ago, when their present water supply was turned on by the Duchess of Montrose, they thought it would serve them for the next twenty years to come. Since then, however, water pipes had been laid in all directions; and the Trust in making these extensions exhausted their capital. Consequently they had to go to Parliament to obtain a Bill to give them additional borrowing powers, and power to extend their works. They had so arranged their borrowing powers that they could assess the next generation as well as the present, and so that the father could not say to his son that he would have no taxes to pay. He thought that the Water Trust deserved the greatest praise for bringing in this grand scheme, and for having reduced the water rate to 1s. per pound.

Provost FERGUSON, of Denny, next proposed "The Falkirk Gas Commission."

Bailie HAMILTON, in responding, said that the reason why they were in the proud position of having improved their gas undertaking to the extent which it had been improved, was that the Gas Commissioners had worked together as one man. As they were all aware, when they proposed to take over the gas-works from the Gas Company they thought they would only have to pay according to the value of the works as works; but the Arbiters decided that the works must be purchased as a going concern, which was quite a different matter. Notwithstanding the high price they had paid for the works, however, they were able, in lieu of dividends in the first year, to take 5d. per 1000 cubic feet off the price of gas. The Gas Commissioners flattered themselves that when they took over the works they would have a large increase in business. They had consequently improved the quality of the gas to a large extent; and they would comprehend the extent of this improvement when he said that the illuminating power of the gas now was something like 26-candle power. They gave £80,000 for the gas undertaking; and they soon saw that they would require to spend from £10,000 to £15,000 in improvements. After consideration, they arrived at the conclusion that the best way to produce good gas, and cheapen the price of it, was to go in for Hislop's patent regenerative system, and adopt the Peebles oil gas enrichment process, which they did, and these improvements had resulted in great gain to the Commissioners. Not only had they improved the illuminating power of their gas, but they were working at a cheaper rate than under the old system. They were compelled to erect the beautiful gasholder which they had inaugurated that day, because, as he had said in connection with the ceremony at Parkhouse, the consumption of gas had enormously increased. The new gasholder would contain 540,000 cubic feet of gas; so that in the burgh they had now a total storage capacity of 880,000 cubic feet. This showed that they were looking forward to the future; but they hoped that for a year or two they would not require to do anything further in the way of extensions. It had taken some 800 tons of steel to build the new holder; and the tank in which it worked held over 2 million gallons of water.

A number of other toasts were given.

SALE OF STOCKS AND SHARES.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards conducted a sale by auction of stocks and shares in various Gas Companies. The first lots submitted consisted of 200 "E" £10 preference shares (5 per cent.) in the Aldershot Gas and Water Company; forming part of the new issue. They were put up in parcels of ten, and were disposed of at £14 and £14 2s. 6d. per share. By instructions received from a private owner, 31 fully-paid £10 preference shares, bearing the same rate of interest as the preceding, and carrying the amount accruing from July last, were submitted, and were purchased for £13 17s. 6d. and £14 each. A parcel of £200 of original ordinary consolidated stock of the Brighton and Hove General Gas Company, the last dividend on which, under the sliding-scale, was at the rate of 11½ per cent. per annum, was knocked down at the rate of £287 10s. per cent.; the purchaser taking the dividend accruing from the 1st of July last. A new issue of £5000 of ordinary stock of the Guildford Gas Company was next offered. It ranked for a standard dividend of 5 per cent., subject to the sliding-scale, and carried that accruing from the 1st prox. The entire amount was put up in thirty-five £100 and thirty £50 lots, which were knocked down at the following prices per £100 of stock: Two at £130; six at £127 10s.; eleven at £126; three at £125 17s. 6d; twelve at £125 15s.; ten at £125 12s. 6d.; four at £125 10s.; and seventeen at £125. The next lots consisted of £10 fully-paid shares in the West Ham Gas Company, the last dividend on which was at the rate of 6½ per cent. per annum. They were sold, *cum div.* as from July last, at £16 2s. 6d. and £16 per share. A few £30 fully-paid 7½ per cent. shares in the Great Yarmouth Gas Company found purchasers at £56 and £56 10s. per share. Some £10 "A" shares (10 per cent.) in the Hampton Court Gas Company were sold at £25 apiece; and some "B" shares of like nominal value, carrying 7 per cent. dividend, at £17 each. The final lots were eight fully-paid £10 shares in the Bishop's Stortford Gas Company, which were knocked down at £23 per share.

THE PROPOSED MUNICIPAL GAS SUPPLY FOR VIENNA.

"The Times" Vienna Correspondent on the Question.

Writing last Tuesday, the Vienna Correspondent of "The Times" gave the following account of the above matter, as an example of the way in which foreign undertakings are treated in Austria:—

The Imperial Continental Gas Association have supplied Vienna with gas for more than fifty years under different contracts. The last of these, concluded in 1875, expires on Oct. 31, 1899. Under this contract, the City had the right to take over the works at a valuation, on condition of their giving notice of their intention to do so not later than the 31st of October last. The estimate which was to determine the value of the works was to begin in 1895. But the City urged that one year was not enough; so the Association consented to allow the valuation to be begun in January, 1893. The result was that the value of the works as existing up to that date was fixed at about £1,350,000. The works and mains were declared by the experts to be up to date, and adapted for carrying on the gas supply for some years to come. By paying £1,350,000, the City could therefore enter into possession of the works and business of the Association, if they gave the proper notice in October, 1896.

For years past, the gas question has, however, been treated as an electioneering cry by the Radical opposition, and afterwards by the anti-Semitic party. In technical circles, the amount of the estimate seems to have been considered low. But the City, nevertheless, wanted the Association to accept about half the sum, and threatened to

build works of their own which would practically convert the property of the Association into old iron. Last year the anti-Semitic party, who, while in opposition had declaimed against all idea of a compromise with the Association which should not be a complete surrender, came into office. Some negotiations took place which, however, led to nothing, owing to the Association refusing to make any reduction in the valuation; and finally the Municipal Council, under the influence of Dr. Lueger, and despite the opposition of the minority, decided not to take over the works, but to build their own. The usual abuse of the English was indulged in, and appeals to common sense were hooted down. The Association offered to divide their profits with the City on very reasonable conditions, or, if it was preferred to give all the advantage to the gas consumers, they offered to reduce the price for private lighting. The City, therefore, had the choice of three courses—to renew the contract with the Association and become part owner of the business, to purchase the works at a low price, or to build new ones of their own. They chose the last.

The original estimate of the cost of building new works by the town was £2,500,000. It is now generally admitted that they will cost about £3,300,000. The entire technical staff of the City, with one exception, have warned the Municipality against entering upon the undertaking. When it was clear that their counsel was to be overridden by the anti-Semitic leaders, they agreed to carry out any orders they might receive, but declined to accept any responsibility for the success of the undertaking or its timely completion. The difficulties to be overcome are as follows: Whereas the Association light Vienna from six works, it is proposed by the present scheme to light it from one. It has been pointed out that, owing to differences of level, this will be difficult, especially in the large district on the other side of the Danube Canal. It has also been pointed out that, by having only one source of supply, the lighting of the town might be at any time endangered, as in case of floods, a strike, or some other disturbance. Moreover, it is highly questionable whether the mains can be laid in the time—namely, 2¾ years—or, in fact, whether they can be laid at all. The system of mains in Vienna is upwards of 500 miles long. It is therefore proposed to break up 500 miles of streets once in order to lay the mains, a second time to lay and connect the services, and a third time to remove the mains of the Association. The contract entitles the city to call upon the Association to continue the public lighting for one year after 1899. They have, therefore, four years within which to lay the mains and connect them with the houses. It has been calculated by the municipal experts that, owing to climatic causes, there are only 200 days in the year on which main laying can be carried on. The whole of this gigantic work would, therefore, have to be executed in 800 days. It would thus be necessary to lay five-eighths of a mile of mains a day in the crowded streets. But, in addition to this, it must be remembered that the Emperor's Jubilee takes place in 1898, that Vienna will be visited by the crowned heads of Europe, and that an International Exhibition will take place, for which reasons a general breaking up of the streets will be impossible. A movement has therefore begun among the owners of house property, more than 3000 of whom have called upon the Government to protect them from the consequences of this needless operation, which will cause incalculable damage to property, and will seriously interfere with the commercial and industrial life of the town. Forty-three of the Trade Guilds had made similar representations to the Council before the vote was taken. There is a lawsuit pending as to the suburban contracts, some of which run to 1917. The City contends that the Association lose their rights in consequence of the recent incorporation of the suburbs known as the creation of Greater Vienna.

The Southbank Gas Explosions.—With reference to the recent explosions of gas at Southbank, we learn that, on the recommendation of the Streets Committee, the District Council have resolved to keep the steam-roller off the streets at present "for fear of further damage being done to the gas-mains."

A Gas Explosion Attributed to Incandescent Gas-Lamp Bye-Passes.—An explosion of gas occurred yesterday week in the Manager's private apartments at Messrs. Lacon's Bank at Cromer. It took place in the drawing-room, which is illuminated by a three-light chandelier fitted with incandescent burners, with bye-pass arrangements. It had been noticed that there was an escape of gas in the house; and, as no light had been taken into the drawing-room previous to the explosion, it is assumed that the flash-lights were responsible for the mischief. The Manager's wife was rather seriously burnt; and the room was completely wrecked.

The Price of Gas at Alton.—The Alton District Council have been leading a local agitation for obtaining a reduction in the price of gas supplied by the Alton Gas Company; and though the movement has ended in nothing, the particulars appertaining thereto are worthy of being recorded, as they serve as an illustration of how easy it is to institute comparisons which, while appearing applicable and fair at first sight, are entirely erroneous when they are subjected to examination. The Alton Council urged that, because Aldershot was so near to Alton, gas could be sold at the two places at about the same price. Mr. G. Hall, the Chairman of the Alton Gas Company, has most effectually disposed of this contention, by pointing out that the cost of coals and cartage at Alton is much more than at Aldershot, while the annual make of gas at the former place is about 12 million cubic feet, as compared with about 120 million cubic feet at the latter. At Aldershot, again, the gas and water works are carried on by one Company; and the profit on the water supply helps to reduce the price of gas. The Council put forth the statement that gas at Alton costs 4s. 2d. per 1000 cubic feet, whereas the cash price is 4s. In drawing attention to this, Mr. Hall pointed out that the district rate in Alton is much higher than at Aldershot, where for many years it has been 3s. in the pound, against 3s. 11d. at Alton. Towards this rate the Alton Gas Company have been called upon to pay £59 11s. 11d. He concluded by saying the Directors had always been willing to meet the desires of the Council; but as they only pay £250 a year in dividends, and the reserve fund stands at but £130, they did not see that they would be justified in reducing their charges.

ELECTRIC LIGHTING NOTES.

The town councillors of Torquay are badly bitten by the electric light craze. On most subjects they are at hopeless variance, but on the electric light question they are unanimous; and, like some more famous personages, when they do agree, their agreement is wonderful. Last Tuesday week, the Electric Light Committee presented a report in which they recommended the acceptance of certain tenders, amounting on the whole to £20,101, for works connected with the proposed installation. There was some discussion upon the merits of two of the firms who had submitted offers, in which it transpired that the Committee had ignored the recommendation of their Engineer in the matter. There was also a suggestion that, for a beginning, it would be wise to confine the supply of the current to the compulsory area, and leave the outside district until a demand was created. But neither the objection to the firm to which part of the work is to be given nor the suggestion to restrict the expenditure seems to have been seriously meant, for the recommendations of the Committee were unanimously adopted. One of the members commented on the "marvellous spirit of economy" running through the Council, and the desire which was manifested to drop everything but the electric light. The pledge was again given that no nuisance would be felt in the Bath Saloons, which are contiguous to the proposed central station. "An eminent Manchester electrical engineer" was quoted as authority for the pledge that there was no possibility of vibration at the saloons; but it was admitted that there might be a slight humming noise.

The Hull Town Council have recently had two long discussions on the proposed scheme for extending the present electric lighting installation in the town by the adoption of the high-pressure tension system, at a cost of £42,000. On the first occasion, objection was taken on the ground that, as the low-tension principle was a proved success, it ought to be continued; and it was decided to remit the minutes for further consideration. The Committee, however, determined to again submit the minutes to the Council. This was done last Thursday, when, after doubtful points had been cleared up by the Consulting Engineer (Mr. R. Hammond), the scheme was adopted.

Among the places for which electric lighting powers are to be applied for next session, as mentioned in the "JOURNAL" for the 1st inst., are Leatherhead, Rottingdean, and Walton-on-Thames. Three Companies have lately been registered for the supply of these towns; their objects embracing, among other things, the industries of electricity supply, mechanical engineering, manufacture of electrical apparatus, telephones, telegraphs, phonographs, and bells. Their scope cannot therefore be said to be limited; but how they are going to carry on their extensive business with the amount of nominal capital at their disposal—£1000—is a marvel. Our contemporary "Lightning," which is rather expert at analyzing the financial affairs of electric lighting undertakings, confesses to being unable to understand what the promoters of these concerns intend to do with them.

At the request of the Hackney Vestry, Mr. F. Hastings Medhurst has submitted the draft of a scheme by which the parish can be lighted by electricity by the judicious utilization of the refuse of the streets, which has hitherto cost upwards of £8000 to collect and dispose of. Mr. Medhurst proposes an initial installation which will enable 16,000 private lights of 8-candle power to be in connection with the mains, in addition to the 140 arc lamps of 1000-candle power each, which will be required to efficiently illuminate the suggested list of streets. The advisability is pointed out of adopting the high-tension alternating current system, with low-tension mains radiating from transformer sub-stations. On the subject of financial consideration, a charge of 5d. per unit to private consumers is recommended, which will be the lowest rate charged during the night throughout the whole of London. The total capital outlay is set down at £79,120. The income is computed at £10,685; and the working expenses would come to £5357—thus leaving a balance of £5328. The interest and sinking fund on the capital outlay would amount to £4000 per annum; leaving a net profit of about £1328 a year, which, in practice, Mr. Medhurst thinks, would amount to £2000.

At a meeting of the Tunbridge Wells Town Council on the 2nd inst., several members very strongly criticized the action of the Lighting Committee in regard to the working of the electric light. Mr. Strange, in particular, condemned the defects of the system, pointing out that the light was very defective in some places. Sir David Salomons said that at first the Council advocated close economy as regarded expenditure on the electric light; but now some of them wanted to go to the other extreme. He quite agreed that more lamps were required in some parts of the town. Mr. Howis, as a member of the Committee, considered the public lighting was carried out in the best interests of the borough. Alderman Stone-Wigg asked if any arrangement had been made with the Gas Company in regard to incandescent street lighting. Mr. Wood replied that the Company had put the present experimental light up at their own cost; and the Lighting Committee now wished to ascertain what was the Company's experience of the cost. Mr. Penn said the Committee were studying economy more than efficiency; and he moved that various recommendations made by them as to the public lighting should be referred back for further consideration. Mr. Strange seconded the motion. Alderman Delves said that less than one-tenth of the town was benefited by the electric light, because of the policy of the Committee in not efficiently lighting the side streets; and he reminded the Council that the electric light was costing them £500 a year extra. Alderman Cronk considered that the use of arc lamps in a town like Tunbridge Wells was wrong. He preferred the small electric lamps in the existing gas-lamps in contrast with the large arc lamps. The Committee must know very well that the streets were badly lighted. They did not want concentrated, so much as distributed light. If the incandescent gas-lamp was good enough for the purpose, let them have it; and he believed that, if the Lighting Committee would look at the matter fairly, they would conclude that incandescent gas-lamps were best. The motion was lost.

The Trade Unionists of Tunbridge Wells have fallen foul of the Borough Electric Lighting Committee; and, through the quarrel, some light is thrown upon the way in which the electric lighting scheme of the Corporation has been made to show certain "saving results as

compared with other systems of lighting." At a special meeting of the Tunbridge Wells Trade Union Council last Wednesday week, the Hon. Secretary (Mr. Croxon) said he had to bring forward the action of those responsible for the management of the electric lighting station in working the employees too many hours a week; and he asked the Council to request the Corporation to at once investigate the number of hours' service and the wages paid to the whole of the men under the control of the Engineer, with a view to bringing about a more equitable and honourable state of affairs. The standard of the Union was 56 hours per week; but a young man who came from London with his family had been treated in a shameful manner. He took a job at the electric lighting works, at 30s. a week and 6½d. per hour overtime. But the latter only commenced at the end of 60 hours; and the man had worked 71, 76, 87, 92, and even 96 hours. Their working man councillor asked a question as to why this employee was discharged on suspicion of having written to the local papers on the way in which the works were managed, and also as to whether he had not worked from 60 to 80 hours' overtime without any extra pay. The latter was, however, a mistake, because overtime was paid for. Whereupon Mr. Wood gave a general denial to the statements, and contended that the wages paid were better than at other electric lighting stations. He concluded by stating that the man was discharged owing to a change in the working arrangements. It was not true to say that the wages were the same at other places; and he (Mr. Croxon) moved—"That the Corporation be asked to investigate the hours of work and the rate of wages paid to the whole of the men under the control of the Electrical Engineer, with a view to bringing about a more equitable and honourable state of affairs." Mr. Bourne seconded the motion, and mentioned an instance where one employee worked more than 90 hours a week. Mr. W. Thorne asked the town labourers to join the Gas Workers' Union, which, he said, would fight their battles for them. Mr. Bourne said the Town Council were afflicted with a tendency to pay low wages, except in the case of the clerks. Mr. Wood no doubt wanted to show the gas shareholders in the Council, who were opposing the electric light, that it was cheaper than gas; but the Trade Unionists of the borough were determined that this should not be effected at the expense of the working men, if they could possibly avoid it. The motion was carried unanimously.

The summons of Messrs. Oetzmann and Co. against the Dublin Corporation for failing to supply electric light to their premises in Grafton Street, Dublin, has had no definite result. When the case was before the Magistrate (Mr. Byrne) at the Southern Police Court on the first occasion, it was stated by Counsel for the Corporation (Mr. Macinerney, Q.C.) that the current would be furnished on the following Wednesday. This was done; and when the proceedings were resumed on the 30th ult., Mr. Day, for the plaintiffs, announced that, as they had attained their object in bringing the summons, he would drop the case, unless the Corporation applied for costs, which, under the circumstances, would be a most audacious proceeding. Mr. Macinerney contended that the plaintiffs had no case for a penalty; and he asked that the summons be dismissed in the ordinary way on the hearing of the case, and that costs be given to the Corporation, who had unfairly and improperly been put to expense. Mr. Byrne, in giving his decision, said the plaintiffs' complaint was that the Corporation did not furnish them with electric light; and they submitted that the Corporation were liable to penalties not exceeding 40s. a day for the long space of time intervening between Jan. 1 this year and the issuing of the summons. Plaintiffs relied on section 24 of the Corporation Electric Lighting Order. The first step towards establishing liability to a penalty was to prove that a requisition for a supply of electric energy under this Order was served on the Corporation. Section 22 showed that the requisition should contain a specification of the premises in respect of which the supply was needed; the maximum power required; and the day—not being an earlier day than a reasonable time after the date of the service of the notice—on which the supply was required to commence. It was conceded that no notice was served containing these three requisites. But plaintiffs submitted that the Corporation by the negotiations and correspondence between the parties from Jan. 1, 1895, to the present month, were estopped from relying on this defect. In administering this penal statute, there was no estoppel enabling him (Mr. Byrne) to dispense with the requisites of the Order for establishing a liability to the penalties, and therefore as the requisite notice was not served before the prosecution was commenced, he dismissed the summons, but without costs.

There were two points of interest in the report presented by the Electric Lighting Committee at the meeting of the Dublin Municipal Council on Monday last week. One had reference to the increase in the premium charges of the insurance companies on electric lighting works, and the other to an additional loan for the undertaking. The adoption of the report was moved by Mr. Buckley, who said that hitherto the department had been charged only 2s. 6d. per cent. by the insurance companies; but now all the companies had joined in a boycott, and refused to accept the insurance risks unless they paid 10s. 6d. on the mains and 12s. 6d. on the buildings. The report also asked the Council to sanction a loan of £50,000; and this, said Mr. Buckley, raised an exceedingly important question as to the borrowing powers of the Corporation. The Inspector of the Local Government Board (Mr. C. P. Cotton) was of opinion that all the borrowing powers of the Corporation had been exhausted down to about £40,600. But this included the waterworks, which cost £700,000; and the electric light works, which cost £60,000; and these were paying undertakings, which he thought, should not be set against the borrowing power of the Corporation. There was a fairly lively discussion on these matters, in the course of which one member—doubtless having in view the above action against the Corporation—gave it as his opinion that the legal liability of the Corporation rendered it absolutely necessary that £100,000 rather than £50,000 should be spent on the installation. It was also pointed out that the entire capacity of the electric light station was exhausted, and there were large demands on the Committee for supplies. Mr. Buckley accused members of the Council interested in the Gas Company of instigating citizens to throw difficulties in the way of the Committee. The motion was adopted, with an addition referring the financial question as to the Corporation's borrowing powers to a Committee of the Whole House.

In the "JOURNAL" for the 1st inst., we gave, among the "Electric Lighting Memoranda," some observations by the Mayor of Redfern—a borough adjacent to Sydney—on the electric lighting of the town. Since they appeared, we have received from a correspondent a report of the entire speech made by his Worship on the occasion referred to; and we extract therefrom the following additional remarks: "The installation at Redfern cost £19,000. Of course, we have two sets of engines; it is necessary always to have double power. If we work the left-hand engine this week, we must have the right-hand engine ready to take up the work at a moment's notice, in case anything goes wrong. Sometimes people come to me and say the light is going out. There is perhaps some trifling thing wrong; and the connection has to be switched off, and it takes a few minutes to put right. This is how the cost is added to. You must have double power—twice the power required for a particular work, for use in case anything goes wrong. Now I find that the expenses—that is, the working expenses—may be put down roughly at £1500 per annum. The interest—5 per cent. on £19,000—is (say) £1000 a year. Then you must have a sinking fund of 2½ or 3 per cent. You want to put down a sum calculated on the life of the engines and cables, cost of renewals, &c.; and when you have reckoned all this, you will find that the business of street lighting only will not pay you. You had better pay £4 10s. per lamp than go in for electric street lighting only—that is, in the present state of development of electricity. We have 411 lamps in Redfern, and the lighting rate is 3d. Work out 411 lamps at £4 10s.—say, £1850 a year. That is what we should be paying the Gas Company for the same number of lights; whereas we are now charging the ratepayers about £2200, for that is what the rate comes to at 3d. in the pound. In addition to this £2200, we may take the possible revenue to be derived from our plant for house lighting purposes, which would be £1200 per annum. It will require every pennypiece of that to pay the working expenses, renewals, interest on money, and provide a sinking fund. You will find that electric lighting is a most troublesome business to undertake, and one which, I respectfully suggest, should never be undertaken by a body of Aldermen. Even now, if our lighting were in the hands of a company, I am certain that no company looking to financial results—and few work for philanthropic reasons—would dream of supplying the light for household purposes at the prices we are doing. We sell at 5½d. per Board of Trade unit. All household lighting is based upon that. I find from statistics from the Mother Country, that industrial companies which supply the light there are charging not less than 7d. or 8d. per Board of Trade unit. Therefore our price for household lighting is too low. Instead of getting possibly £1200 a year, we ought to get £2000 for the same consumption of coal and energy distributed. I do not say this with a wish to have the appearance of tying your hands in dealing with your Gas Company; but I feel certain that if we had spent the same amount of money on gas manufacture under our own control, we should be in a far sounder position financially in respect to this particular industry than we are now." It may be added that these remarks came from one who was always an opponent of the local Gas Company.

The Rotherhithe Vestry have declined to consent to the application of Mr. S. Morse, on behalf of the County of London and Brush Provincial Electric Lighting Company, Limited, for sanction to the application of the Company for a Provisional Order in respect of Rotherhithe. On hearing of this decision, the Company held out the bait that an agreement would be entered into to supply electric current for street lighting at 3½d. per unit, and to give the Vestry an opportunity of purchasing the undertaking at the expiration of a time to be specified. The Vestry have resolved to abide by their first decision.

A Local Government Board inquiry has been held at Portsmouth regarding an application by the Corporation for power to borrow £16,020 for electric lighting purposes. It is proposed to spend £10,005 on new machinery, and the remainder on extensions. The Inspector was informed that the profits on the undertaking were 7½ per cent. gross and 2½ per cent. net.

The Committee who direct the business of the St. Pancras Electric Lighting Department are sadly perturbed over the dilatory treatment of the London County Council with regard to the Vestry's application for a further loan of £10,000. These gentlemen have been given to understand that the Council are "not prepared at present to advance more than £6540;" and the Vestry Clerk has asked the instruction of the Committee "to take up this latter sum as soon as possible." Surely it cannot be that this highly successful and profitable undertaking is again in need of financial assistance? The Committee reported to the Vestry last Wednesday that they had authorized their Vestry Clerk "to endeavour to complete, with as little delay as possible, a loan of £6540, on the understanding that the question of the balance may be dealt with hereafter, that the advance is on account of the £10,000 applied for, and that the rate of interest shall be 2⅞ per cent." At a later stage of the proceedings, the Vestry decided that the electric light be installed at the Whitfield Street Baths and Washhouses; "the cost of wiring and of fittings to be borne by the Electricity Department." But as the ratepayers support both departments, it really matters little through what channel the money is paid.

At the meeting of the Ipswich Town Council last Wednesday, a formal resolution recommending the affixing of the common seal to a memorial to the Board of Trade for a Provisional Order for electric lighting brought the adherents of the present system of incandescent gas lighting and those of electric lighting into wordy conflict. The motion was introduced and seconded in a few remarks; and a protest was then entered against it by Mr. E. P. Ridley, whose opinion was that the present public lighting by incandescent gas-lamps was as satisfactory as it could possibly be. Even if the Electric Lighting Order was of no other use, Mr. A. Cattermole saw in its possession an instrument which would enable the Council to make better terms with the Gas Company for the continuance of the present system of lighting, after the existing three years' agreement had expired, if it were considered desirable. He referred to Yarmouth as an example of what could be done in this way. There, he said, the Corporation held an Electric Lighting Order, and were able to compel the Gas Company to adopt the incandescent system without any extra cost to the town. In Ipswich, on the other hand, the Corporation had no such Order; and they had at present to pay the Company an extra £120 or £140 a

year for the incandescent lights. Alderman Josselyn took exception to the statement in the memorial that it was "expedient" to obtain powers to provide electric lighting, for public and private purposes. In his opinion, it had not been proved in any way that such powers were "expedient" for public purposes. Under the improved conditions of gas lighting, it could hardly be declared expedient to adopt a more expensive light for public buildings than they had at present; and, as to the streets, he maintained that many of these were unfitted for lighting by electricity. He was very glad the Council would be able to lease their powers, if such a course were thought advisable; and so give a company the chance of burning their fingers over the experiment. Mr. John Pratt, one of the leading advocates for the electric light in the Council, pointed to what was being done at Norwich with that illuminant. There he found that five out of every six of the best shops were lighted with electricity. The first year the undertaking paid 3 per cent., the second year 3½ per cent., and carried forward £1100; and this year they were in a better position than they had ever been before. Alluding to an assertion made at a previous meeting of the Council, that electricity at 6d. per unit was equal to gas at 3s. per 1000 cubic feet, Mr. H. J. W. Jervis stated that it was admitted in the text-books that the relation of the price of electricity at 6d. per unit to 1000 cubic feet of gas was something like 5s. 6d. to 6s. 6d. Other figures in the text-books (which might well cause the Council to pause) were these—that sixpennyworth of electricity would give 320-candle power; that sixpennyworth of gas burned in flat-flamed burners would give 466-candle power; and that sixpennyworth of gas used with incandescent burners would give 2500-candle power. Mr. Jervis also urged that at Chelmsford it had been demonstrated that electricity in the incandescent form was most unsuitable for street-lighting purposes; and the light far inferior to that afforded by incandescent gas-burners. In reply to Mr. Cattermole's argument, that the Council should get this Order so as to obtain certain advantages from the Gas Company, Mr. Jervis said he thought the Company had treated the town very liberally. In this remark, most of the members cordially acquiesced. He added that Mr. Cattermole had said the Company made an extra charge for incandescent lamps; but this, he reminded the members, was for a very large expenditure of capital—some £1000—for converting the old burners to the incandescent system. In the discussion, the best speaking and arguments were undoubtedly on the side of gas; but, on a division, the motion was carried by 17 votes to 5.

The Lambeth Vestry have notified in the "London Gazette" that they propose, with the consent of the Board of Trade, to transfer to the South London Electric Supply Corporation their Electric Lighting Order. The Vestry reserve the right to purchase the undertaking at stated periods on specified terms. The Corporation will pay the Vestry £1000 to cover expenses connected with the Order. They also pay a deposit of £5000 as a guarantee to complete the compulsory work within two years; the Vestry paying 2 per cent. interest. But the deposit is to be forfeited to the Vestry if the works are not completed within three years. The Corporation will supply current free of charge to 25 electric arc lamps.

We learn from a correspondent that the proposal to go in for the electric light at Barking is not likely to advance much further than the Provisional Order stage, inasmuch as the large majority of the ratepayers of the district are men employed at the Beckton Gas-Works, and they have not as yet had a voice in the matter.

After an acrimonious debate, the Newington Vestry have resolved to oppose the County of London and Brush Provincial Electric Lighting Company's application to the Board of Trade for a Provisional Order, though the Company have offered to surrender at the end of ten years. At the same meeting of the Vestry, the appointed experts—Messrs. Kincaid, Waller, and Marville—presented two voluminous reports, estimating an initial expenditure of £40,000, with the amazing profit of ½ per cent., with a charge of 5½d. per unit. The idea of a combined dust destructor was condemned.

The St. Saviour's Board of Works passed the following resolution at their last meeting: "That the General Purposes Committee be instructed to inquire as to the feasibility of substituting electricity for gas as a street illuminant in this district." This action is admittedly connected with the agitation now in progress with a view to amalgamating Southwark with the City of London. In that case, the City's system would doubtless be extended across the river.

Petroleum Incandescent Lamp Company, Limited.—A Company has been formed with the above title, with a capital of £100, in £1 shares, to acquire certain patents relating to improvements in the manufacture of petroleum burners, and to develop and turn them to account. It has been registered by Messrs. Faithfull and Owen, the Solicitors to the Incandescent Gas-Light Company, Limited.

The Gas Supply of Cranbrook.—A parish meeting has been held at Cranbrook for the purpose of considering a suggestion for taking over the works of the Cranbrook Gas Company. The meeting is the outcome of a recent increase of 3d. per 1000 cubic feet in the price of gas, which the Company have thought fit to make in consequence of the necessary erection of a new holder at a cost of about £1000. After discussion, a resolution was passed requesting the Chairman of the meeting (Dr. Joyce) to address a letter to the Company, asking if they are willing to sell their works at a fair valuation, and at what price.

Wokingham Corporation Gas-Works.—The accounts of the Wokingham Corporation Gas Committee for the year ending Sept. 30 last have been presented to the Council. The revenue account shows an expenditure of £1262, as against £1357 in the preceding year. The receipts, owing to a reduction in the price of gas of 6d. per 1000 cubic feet in October, 1895, have diminished by about £128; and the income from coke has decreased by £41. However, the Committee feel that the working of the undertaking has been, on the whole, most satisfactory. The consumption of gas is steadily increasing; and two new benches of larger retorts have been added to the works to meet the demands. The distribution system has been improved by the replacing of some of the old mains by new and larger ones; and the leakage of gas has, in consequence, been reduced from 7·35 per cent. to slightly above 5 per cent.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Purchase Bills Sanctioned.

At the Meeting of the London County Council last Tuesday—Sir A. Arnold in the chair—a recommendation of the Parliamentary Committee to promote eight Bills for the acquisition of the undertakings of the Water Companies was discussed in connection with a report presented by the Committee on the subject. In the course thereof, they stated that, acting upon the resolution of the Council passed on the 10th ult., instructing them to "prepare a Bill or Bills for the purchase of the undertakings of the Metropolitan Water Companies," on certain lines therein set forth (see *ante*, p. 977), they had come to the conclusion that it would be advisable to introduce eight separate Bills—one for the purchase of each of the Companies' works, subject to the proviso that, if the Council acquired any one or more of the undertakings, they should also proceed with the object of acquiring the rest. The Committee stated that the whole matter had been most carefully considered by a Special Sub-Committee, who had reported from time to time, and had now submitted the Bills for approval. They had been drafted in strict accordance with the resolution of the Council, with the exception of two points, with respect to which they had found it necessary to make some variation. The first was with regard to the clause relating to the purchase of the undertakings in default of agreement. In the Water Bills formerly promoted by the Council, they undertook that, failing agreement, they would proceed to purchase the undertakings under arbitration clauses. They had most carefully considered the proposal that in the present Bills the Council should take powers to purchase within a year; but that, while the obligation to sell was imposed upon the Companies, there should be no corresponding obligation on the Council to purchase. They drafted the Bill in this form in the first instance; but they had been advised by the Parliamentary Agent that this course was inconsistent with recent decisions of Parliamentary Committees in similar cases. They had accordingly sought other professional advice on the point, which was strongly in support of the Agent's opinion. They were advised that the Committee of Parliament would certainly require to know whether in fact the Council intended to purchase; and in the absence of any such assurance, they would probably refuse to proceed with the inquiry. Under these circumstances, the Committee had settled the clause in the form in which it appeared in the Bills. The other point to which they thought it necessary to direct attention arose in connection with the resolution relating to agreements for the transfer of works and powers to local authorities [paragraph (*c*), p. 978]. They had thought it best to draft the clauses in the Bills dealing with the matter in the present form, as they were now engaged, in accordance with the authority given them by the Council on the 10th ult., negotiating with the outside authorities, and hoped to have arrived at agreements with them before the Bills reached the Committee stage in the House, when it would be possible to put forward any necessary amendments. The Committee recommended the Council to approve of the eight Bills, as well as of the London Water-Works (Purchase) Bill, by which they seek authority to raise and expend money on capital account in connection with the purchase of the Water Companies' undertakings. To the first recommendation, Sir John Lubbock, Bart., M.P., had given notice to move the following amendment: "That, in the opinion of the Council, a well-considered system of control of the Water Companies would, under existing circumstances, be preferable to the proposals for purchase contained in the Water Bills presented to the Council by the Parliamentary Committee."

The report having been received,

The Hon. E. Hubbard, M.P., protested emphatically against the principle involved in the Bills. Their introduction was, he said, an absolute waste of time and money. They would meet with strenuous opposition outside the Council, and had no chance of passing.

The Chairman said the speaker was not in order in discussing the question of policy when the matter before the Council was the approval or otherwise of the Bills, brought up under a resolution of the Council. An amendment standing in the name of Sir John Lubbock was also out of order for the same reason.

Sir J. Lubbock said there was a Standing Order of the Council that no resolution dealing with an expenditure of more than £5000 should be taken without at least one week's notice. These Bills involved at least £40,000,000; and yet the resolution approving them was brought on at two days' notice. He protested at the time; but he was told that, by the rules of Parliament, it was technically necessary that the Bills should be deposited at once, if at all this year. He certainly understood, however, that some opportunity would be afforded of discussing the policy of the Bills. He appealed, therefore, to the Chairman of the Parliamentary Committee to give them a chance of discussing the advisability of purchase on its merits. If this were refused, he could only record his most respectful protest at the course adopted by the Committee, and the surprise sprung on the Council. It was certainly most extraordinary that they should be committed to a policy involving so immense a sum, and, on technical grounds, refused an opportunity of discussing the Bills on their merits.

The Chairman said he was utterly powerless in the matter. They must proceed according to the Standing Orders.

Lord Onslow said he did not desire to question the Chairman's ruling; but he wished to point out that a good many of the clauses were not in accordance with the resolutions of the Council.

Mr. M'Kinnon Wood (the Chairman of the Committee) pointed out that on Nov. 10 the Council discussed the question of policy at great length.

The Council then proceeded to consider the Lambeth Bill as an example of the others.

Mr. H. P. Harris moved an amendment to clause 4, the effect of which would be to make the purchase within one year of the Bill permissive instead of compulsory, by substituting the word "may" for "shall." He pointed out that, if the amendment were accepted, the Bill would be in accordance with the resolutions of the Council, and

with the arrangements come to between the leaders of the two parties when this particular point was discussed.

The Hon. L. HOLLAND, M.P., seconded the amendment.

Mr. M'KINNON WOOD said it was true that an agreement was come to. The Progressives departed from their own strongly-felt opinions, and they had stated that they considered they were imperilling the Bills because they felt they would be putting a strong argument in the mouth of the Counsel for the Companies, and one which it would be difficult for them to meet.

Mr. BEACHCROFT supported the amendment.

Mr. DICKINSON, in opposing, said the adoption of the recommendation would mean the wrecking of the Bills.

A division was taken on the amendment, which was defeated by 53 votes to 51.

On clause 6, relating to the powers of the arbitrators,

Mr. CAMPBELL moved, as an amendment, that the arbitration tribunal should consist of five members, nominated respectively by the Council, the Water Companies, the High Court of Justice, the Lord Chancellor, and the Board of Trade.

Mr. PORTER seconded the amendment.

On a show of hands, the amendment was lost, and the clause, which provides for the appointment of one or three arbitrators, was agreed to.

On clause 25, dealing with the question of supplying water in districts outside London,

Mr. BEACHCROFT said he desired to move as an amendment that a sub-clause 25 (*a*) should be added, as follows:—

No agreement under the preceding clause shall be valid unless approved by resolutions both of the Council and the local authority, passed at a special meeting at which at least two-thirds of the members are present and vote. If one-third of the members of the Council or local authority should, by notice addressed to the Clerk of the Council or the local authority, so require it, the agreement shall be submitted to the arbitrator or arbitrators appointed for the purpose of Part III. of this Act. In the event of no such arbitrators being appointed, then the Council shall appoint one, and the Board of Trade shall appoint one; such arbitrators to have all the powers given to the arbitrator under Part III. of this Act. The arbitrators acting under this part of the Act shall, when an agreement is referred to them, inquire into all the circumstances of the case, and shall decide whether the terms agreed to are reasonable, and whether, in the event of sale or transfer being contemplated, a severance of sources and works is desirable in the interests of all parties concerned, and whether the basis of apportionment of the undertaking and the cost of the same is fair and equitable, having regard to the present and prospective requirements both of the County of London and the district or local authority.

Mr. H. CLARKE seconded the amendment.

On a division, the amendment was lost by 55 votes to 53, and the clause carried.

The remaining clauses were agreed to.

On the recommendation that the eight Bills for the purchase by the Council of the respective undertakings of the Metropolitan Water Companies be approved and deposited,

Sir J. LUBBOCK again protested against the way in which the Parliamentary Committee had dealt with the matter. He said he had not himself received all the Bills; and it had therefore been impossible for him to consider them.

Dr. LONGSTAFF endorsed this complaint.

Mr. H. H. MARKS, M.P., as one who was going to vote for the recommendation, said he protested against the whole course which had characterized the introduction of the Bills; and the one they were now taking seemed like flying in the face of Providence. It was like daring Parliament to hold its own view against a very narrow and insidious majority of the Council.

A division was taken, when there voted: For the recommendation, 61; against, 54—majority for, 7.

On the recommendation that the London Water-Works (Purchase) Bill be approved,

Mr. B. L. COHEN, M.P., moved an amendment to one of the clauses, that power to create perpetual annuities should be deleted.

The Hon. E. HUBBARD seconded the amendment.

Mr. M'KINNON WOOD consenting, the proposal was agreed to; and the Bill, as amended, was approved.

More "Times" Correspondence on the Water Question.

In a previous issue of the "JOURNAL" (*ante*, p. 979) we noticed the principal points brought forward by writers on the Metropolitan Water Question in letters addressed to "The Times." On the 27th ult., there appeared a reply by Mr. H. Clarke to the letter of Sir John Lubbock in which the latter explained his plan of controlling the Water Companies, by placing on their respective Boards representatives of the London County Council and any outside districts interested. Mr. Clarke is unable to agree with Sir John, and thinks there is no alternative but the purchase of the undertakings. He gives this as the result of twelve years' experience on committees. He sharply criticizes the proposal, and says that the life of a representative on a Board would not be a "happy one," while outside he would be blamed if anything went wrong. Mr. Clarke thinks Sir John's example of the Indian railways scarcely fits the case. With regard to the contention that, if the Companies were left alone, they must find themselves obliged to raise capital later on for supplemental supplies, Mr. Clarke is not impressed by it; and the suggestion that the purchase should not take place now, when there is a chance of carrying it through, because of the remote and doubtful possibility of the Companies finding themselves in a corner some years hence, does not commend itself to his judgment. Sir John Lubbock's gratification at the failure of the late Mr. E. J. Smith's purchase scheme of 1889 is shared in by Mr. Clarke, but for quite another reason than that given by Sir John—viz., that, owing to the unforeseen cheapening of money, the purchase price of 32 millions then suggested would cost now, by paying 2½ instead of 3½ per cent., the rate then proposed, £320,000 a year less for interest. Sir John asked: Why not buy up every business paying 3 per cent.—bakers for example. Mr. Clarke fails to see any comparison between water, a natural product in the hands of monopolists, and bread, a manufactured article, subject to no monopoly whatever. Mr. Clarke acknowledges the truth of Sir John Lubbock's statement that the London County Council, if made the Water Authority, would come under the rule of Parliament for repayment of its debt in sixty years, or some such period, and that this would involve having recourse to the rates—at all events, for some years. Since, however, this objection was raised by him in the Council, the Moderate party have favoured the idea of a Trust or Board; and such a body, specially created, ought, he thinks, to have special powers to redeem its loans out of profits—of course, with proper safeguards. In three generations the purchase debt would thus, he says, be redeemed without aid from the rates.

In a letter in "The Times" on Monday last week, Lord Onslow discussed the question of control, and supported Mr. Clarke in his objection to any system based on that followed in the case of the Indian railways. In the course of his letter, he pointed out that there the nature of the control is essentially financial, and exists because the Government is financially interested in the companies. The representative members of the Water Companies' Boards, on the other hand, would not bring any contribution to the common fund, nor would they be looked upon by the shareholders as likely to contribute very materially to their prosperity. He went on to say: "All the directors of an Indian railway company, including the representative of the Government, are interested alike in the financial success of the railway. The Government director has no greater interest in promoting facilities for the travelling public which may diminish revenue than have his colleagues. The representative members on the Water Companies' Boards, on the other hand, would have no interest in the magnitude of the dividend; and their only duty would be to fight for a better and more copious supply of water, regardless of the cost to the Companies. Unless, then, it be proposed that the representative director should have power of absolute veto in the proceedings of the Board, as is the case in nearly all respects with the Government director of Indian railways, it is obvious that his colleagues would on every division place him in a minority consisting of himself alone. If, on the other hand, it be proposed to give him such power of veto, all projects for the spoliation of the Companies invented by the London County Council would fade into obscurity compared with this power of ordering the Companies to new unlimited expenditure for the purpose of giving greater facilities to water consumers without any regard to the financial result on the property of the shareholders. India has had some experience of the application of the principle of control in the days of the East India Company. But it is not difficult to foresee that just as the failure of the old Board of Control led to the elimination of the Company, so any similar attempt to deal with the London Water Companies would only lead to their ultimate expropriation—a process which can be carried into effect at once by the simpler method of an equitable scheme for the purchase of the undertakings now administered by the Companies."

In a letter which appeared last Thursday, Sir John Lubbock replied as follows to the two principal objections raised by Lord Onslow: "As regards the first point, the ratepayers are financially interested in the Water Companies, and are therefore entitled to representatives on the Boards. Let us, for instance, take the case of the West Middlesex Company. Their maximum dividend is limited to 10 per cent., which they are now able to pay, and all surplus profit is the property of the ratepayers, and is bound to be applied to the reduction of the price of water. The ratepayers therefore have a great financial interest in the Company. As regards the second point, the representative members of the Indian railways have no interest in the magnitude of the dividends. That is purely a matter for the shareholders. Their duty is to see that the railways are properly managed, and that no unnecessary expenses are incurred. Similarly, in the case of the Water Companies, one of the allegations which has been made privately, if not publicly, is that, unless some control is exercised, the Companies might be too expensively managed, and thus the interest of the ratepayers might be whittled away. Against this, the presence of nominated directors would be a safeguard. These nominated directors would not have any conflicting interests with those appointed by the shareholders. Control thus exercised would therefore, I believe, work well, and would secure the rights of the ratepayers. It is, however, by no means the only form which might be suggested. If Lord Onslow will forgive me for saying so, I do not think he realizes the great share which the ratepayers already possess in the Water Companies. Lastly, it is quite true, as he indicates, that the importance of the water question is not merely financial, but that there is also the maintenance of a pure supply. In this respect, I submit that purchase would place us at a distinct disadvantage. The filtering requires constant care and watching. At present the officials of the Companies have the fear of the London County Council before their eyes. They know that they are supervised by a watchful and not too friendly critic. But if the supply is controlled by the London County Council, who will criticize them? *Quis custodiet ipsos custodes?*"

GRAND JUNCTION WATER-WORKS COMPANY.

The Half-Yearly General Assembly of this Company was held at the Offices, No. 65, South Molton Street, last Wednesday, under the presidency of Mr. FREDERICK TENDRON.

The SECRETARY (Mr. J. Goodwin) having read the notice calling the meeting, the report was taken as read.

The CHAIRMAN, in moving its adoption, said that the gross ordinary rental of the Company for the year to the 30th of September had been £195,000; and the ordinary expenditure for the same period had been £85,000—leaving £110,000. Out of this, they had paid dividends on all classes of stock and shares amounting to £101,500; and the surplus (£8500) they had used for special expenditure, of which the most important item consisted of lowering the mains. This charge upon them would continue for some time longer. They had lowered about 43 miles of mains; and they had about the same quantity of work still to execute. But they would try to so manage the business of the Company, that they might maintain the dividend of 7½ per cent., and yet carry a

very fair proportion of the cost of the work that was done, as well as of extraordinary expenditure, to the revenue of each half year. If they dealt with it for a twelvemonth, they would see that the ordinary share-earning was 8½ per cent.; and that had been the usual earning of the Company for a great many years. That it had not increased, was mainly due to the very heavy rise in the rates and taxes with which they were constantly saddled. The increase in the quinquennium was so great that they had had to do everything they could to get the amount reduced. A mistaken notion, held by some who had not gone into the water question, was that the increased rental of the Companies was derived from the quinquennial assessment—that the property was valued at a higher rate, and that consequently the water-rental increased. He would, however, put a simple fact before them, which ought to end this belief. The increase of income which the Company would receive during the five years from the higher assessment was about £1500 per annum; but the increased rates they would pay in consequence of the revised quinquennial assessment, would be over £3000 a year. It could not therefore be said that the increased dividends of the Companies came from the higher quinquennial assessment. The amount which their Company had to pay was a grievous charge upon them—something like 12½ per cent. on their gross income. Ratepayers thought that they were heavily burdened if they were charged 40 per cent. of their rental in rates; but a man's rental was not one-fifth or one-sixth of his net, or spendable income. They therefore saw what the tendency was at the present day. It was to constantly put burdens on property, but especially on property held by the public in the form of shares. They sold last June 800 new £50 maximum 7 per cent. shares, at an average of a little over £104 each; the transaction therefore being very successful. Before they finished their new works, they would require a further amount, but not a large sum; and this they would raise by an issue of debenture stock. It was in their power now, when they thought it expedient, and required the money, to issue £15,000 of 4 per cent. debenture stock. It was gratifying to note that the last price marked in the Stock Exchange list for this 4 per cent. stock was £150; so that their credit stood high. The amount they required for the new works was about £90,000, which they had provided. The engines and boilers, with the buildings containing them, to give them ample power, and lessen any strain there might be on their present machinery, would come to about £18,000; the mains, to £38,000 approximately; and filtration, to £34,000. They saw with what willingness the Water Companies met their responsibilities, and how ready they had themselves been to incur additional charge in the way of dividend on these preference shares, to find the money necessary to pay for the works required to ensure an abundant supply; and they saw what a large proportion they were spending on filtration to maintain the almost absolute purity of the supply given to their district. This led him to refer to the question of purity as one of great public interest. It had been brought prominently before the public by the action of the London County Council. The officers of the Council had endeavoured to lead the public to believe that in the course of twelve months they managed to drink some 1400 tons of liquid mud. But when this statement was thoroughly gone into, it really amounted to this—that when a man had drunk 5000 tumblers of water, he would have succeeded in taking into his system one whole grain, but he would have taken that one grain in infinitesimal quantities. Bad, however, as was this attempt to mislead and frighten the public, it was not to be compared with the iniquity—he used the word intentionally—of trying to make the people of London believe that in the water lay the germs of typhoid fever. This was a monstrous charge to bring, and a most injurious one; and it had been combatted most strongly by men of the highest authority—like Professors Crookes and Dewar—who, referring to these statements, said that the mode adopted by the London County Council in providing their samples and keeping them was unscientific. They also said that the results were so at variance with their own, that the samples must have been treated in an unscientific way. Dr. Frankland, who was not a representative in any sense of the Water Companies, but of the Local Government Board, referred to the subject of the possibility of introducing a pathogerm—an injurious bacillus; and with respect to the bacillus to which the analysts of the London County Council alluded, Dr. Frankland called attention to the fact that its presence was no proof of sewage contamination, as it was found in almost all articles of food, and, it was needless to say, was quite harmless. Was it not a strange thing for a public body to try and deter the working classes chiefly from drinking London water? And there was a ludicrous side to it. The very men who had been most active in this—the Progressive party of the County Council—were the teetotal men, and those other members who were most anxious to secure the property of the Water Companies. It was an extraordinary thing the way the Progressive members of the County Council opposed everything which was for the good of water consumers of London; and in this, again, he spoke advisedly. He represented on the Thames Conservancy the Water Companies of London. There were six members of the County Council there, of whom five were Progressives. They would notice the way in which the Progressives would put their own party forward when they had an opportunity of doing so; and what a bad position the Water Companies would have been in had 16 members of the Council been appointed out of the 30 suggested in the late Bill of the Government. As he had said, they had five members out of six at the Thames Conservancy. He had never known one measure brought forward for the good of the consumers which they had not strenuously opposed, if the Water Companies would benefit by it in any way. They opposed the Staines Reservoirs Bill as much as they could; but in spite of that, the measure received the Royal Assent on the 14th of August. In accordance with its provisions, three Directors of their Company, three of the West Middlesex Company, and three of the New River Company were made a Joint Committee to manage the business of the Staines Reservoirs; and it was with much satisfaction that he mentioned that Mr. Walter Hunter and Mr. Middleton had been appointed the Engineers. In this way, by a heavy charge on themselves, they had secured water-rights which would carry them on far into half of the next century. They, however, willingly bore the charges that were involved, and which to a great extent would stop the growth of their dividend. They made this sacrifice for the good they would obtain in the maintenance of their rights, and the discharge of the duty they had undertaken towards their district. It was, however, hard, when they had willingly accepted so heavy a charge, that Parliament should have added another to it—involving at least £7000 a year—by compelling them, from the time they took this water, to provide a sinking fund. It was true they had seven years in which to complete the works, and that the sinking fund might not begin to operate before the end of that time. He had always said that they must not look for an increase of dividend from the benefit of the Staines Reservoirs until some years after they were getting an additional supply from them, and the population had increased to a sufficient extent. No doubt, they were aware that, by a very small majority, the London County Council had decided to bring in Bills again for acquiring the undertakings of the Water Companies. He was not certain as to the nature of the clauses of these Bills; but unless he had read a summary incorrectly, there was one most monstrous condition in them—namely, that they might within a certain period, if they had not come to a friendly arrangement with the Companies, take possession of the latter's properties, even before they had paid the purchase-money, and before the arbitrators had fixed the amount to be paid. He could not for one moment suppose that Parliament would ever allow so gross an injustice to be perpetrated; and they could only hope that the Government, in fulfilment of the pledge they had made, would bring in a just and honest Bill, and that they would remedy the fault found in the last Water Bill of giving an undue preponderance to the representatives of the County Council.

The Right Hon. Viscount KNUTSFORD seconded the resolution; and it was carried unanimously.

The CHAIRMAN afterwards proposed the payment of dividends for the last half year at the rate of 7½ per cent. per annum upon the ordinary share capital of the Company and on the £25 "C" shares, and of 7 per cent. on the £50 "D" shares, together with a dividend in accordance with the conditions of sale on the new £50 "D" shares issued in June.

Mr. F. TAGART seconded the resolution, which was carried.

The CHAIRMAN then stated that the new works involved a heavy expenditure; and they had felt that they did not come within the ordinary category of the services they expected to have rendered to them by their colleague Mr. Hunter. They knew that a Consulting Engineer would in all probability require the usual commission of 5 per cent. They thought that, taking all the circumstances into consideration, a commission of 2½ per cent. was fair to Mr. Hunter, as well as to the Company. He proposed—"That special remuneration at the rate of 2½ per cent. on the cost of the new works mentioned in the report be paid to Mr. Hunter, and on such further new works as they shall from time to time by resolution declare to be new works on which such special remuneration ought to be paid."

Mr. R. A. M'LEAN, in seconding the motion, said that so far as he knew, Mr. Hunter was the author of the Staines Reservoirs scheme itself; and he had never received anything from the Company for the labour he had incurred in connection with it. In the commission proposed to be paid to Mr. Hunter, they were giving less than even professional engineers received.

The CHAIRMAN said that the Directors could not sufficiently express their appreciation of the zealous way in which Mr. Hunter had taken the whole of the work in hand, and without even giving them a hint that he was not satisfied with the very modest fee he was receiving.

The resolution was carried unanimously.

Mr. HUNTER thanked the proprietors sincerely for the vote, and especially the Chairman and Directors for the confidence they had shown in him. The matter was all the more gratifying that it had come from the Court itself, without any solicitation on his part. He had done a large amount of work for the Company; but it was work in which he took the greatest possible interest, and was a labour of love to him. He assured them that he would do all in his power to promote the interests of the Company. He added that he was supported in the engineering department by a most able and zealous staff.

A vote of thanks was then accorded to the Chairman; and the proceedings terminated.

THE WATER QUESTION AT SHEFFIELD.

A Settlement as to the Engineering of the Little Don Scheme.

The much-debated question as to the engineering of the Little Don water scheme of the Sheffield Corporation has at length been set at rest by the acceptance, by the City Council last Wednesday, of the proposals of the Special Committee appointed to effect a compromise between the majority and minority of the Water Committee. These proposals constitute the third scheme that was presented to the Council; and they were fully set forth in the "JOURNAL" for the 24th ult. (p. 1029). Their adoption was moved by Mr. R. Styring, who said the Special Committee had striven to provide in the first instance what they thought to be the wish of the Council, that the new works should be constructed by an engineer of established reputation who should be entirely responsible to the Council. At the same time, so as to ensure the satisfaction of those members who thought Mr. Eaton's special knowledge should be assured to them, the Committee had provided in the scheme that the plans which were to be designed for the carrying out of the work should receive his approval. So far as the financial aspect of the case went, the Committee recommended that the salary to be paid to the Engineer should be from £1200 to £1500 per annum; and Mr. Eaton was to receive £500 for five years for his services in connection with the new scheme. In addition to this, he was to be paid £250 a year for his services as Consulting Engineer in connection with the existing works. The works at Damflask were not perfectly completed. There was still work to be done there; but it was hoped that, within a period of two years, all that remained to be done there would be accomplished. He believed he was right in saying that these terms had been submitted to Mr. Eaton, and he had expressed his approval and satisfaction with them, and said he was willing to render cordial and hearty assistance on the footing of the resolution to be put before the Council. Comparing the financial aspect of the scheme with the one previously submitted to the Council, Mr. Styring quoted figures which showed a total expenditure of £2400

under the present proposals, as against £2900 under the former arrangement. What, however, he thought was of infinitely greater importance was that, in the scheme now submitted to the Council, they would have the services of a competent man exclusively engaged in carrying out the work. Several questions were put and answered, after which Mr. G. Senior introduced an amendment appointing an Engineer-in-Chief at a fixed sum payable by annual instalments, whose duties should include the preparation of the necessary plans of the Langsett reservoir and works, and also a competent Resident Engineer. Mr. Senior argued at length in support of his amendment; and he was backed up by Alderman Franklin, Mr. B. Firth, and others. Several speeches were made in favour of the Committee's proposals; and the subsequent voting on the amendment resulted in its rejection by a majority of eighteen. A further amendment—"That a Consulting Engineer, instead of being permanently retained, be called in at such times and whenever the Committee may deem it desirable"—was proposed by Mr. Wardley. After a short debate, however, it was withdrawn; and the minutes of the Special Committee were unanimously agreed to.

HEYWOOD CORPORATION AND THE WATER SUPPLY TO MIDDLETON.

Last Thursday, Colonel Cope held an inquiry at Heywood relative to an application by the Town Council to the Local Government Board for permission to borrow £35,000 for water-works purposes. The money is chiefly required for new mains to enable the Corporation to give a better supply to Middleton and for other works. Evidence in support of the application was given by Mr. James Diggle, the Borough Engineer; and he was cross-examined by Mr. Bradbury, who appeared for Middleton, as to whether there was any objection to his clients managing their own water-works. Mr. Diggle said that it would be a question of terms; but as the reservoirs, catchment areas, mains, and everything had been purchased as much for Middleton as for Heywood, he thought the price would be prohibitive. He did not know that Middleton had ever asked to have any share in the management of the water-works. But when Heywood proposed to buy them from the Company, the Middleton people refused to join them. Mr. Bradbury, in addressing the Inspector, protested very strongly against further borrowing powers being granted. Middleton, he said, were desirous that their position of being an involuntary partner in a concern in which they had no voice in the management should be put an end to. They were tired of a partnership in a concern which charged extravagantly for water, and over which they had no control or check. They could arrange proper terms for the property of the Water Department in Middleton; and in regard to the supply of water, the relation between Heywood and Middleton should be a commercial one of buyer and seller—that was to say, Middleton should in future be supplied by Heywood with water in bulk at a fair market price. Therefore, he suggested that Heywood should apply to Parliament for power to borrow the money instead of having it granted them by the Local Government Board. If this were done, some such arrangement as he had shadowed forth could be put into the Bill. He asked that the Local Government Board would leave Heywood to go to Parliament in the ordinary way; and then the whole matter could be threshed out. Mr. Pilling, replying for Heywood, said Mr. Bradbury had made a novel suggestion. It was strange that the first complaints and the first representations as to a dissolution of partnership should be made at a time when Heywood was laying herself out to spend money to supply the requirements of Middleton. Nearly the whole of the work to which this loan was to be applied was for improving the water supply of Middleton. The question of the union for water purposes of Heywood and Middleton was before Parliament in 1883. Heywood then proposed to borrow £45,000; and Middleton did not ask that the partnership should be dissolved. Then again in 1889 Heywood obtained borrowing powers from Parliament for work which was as much for the benefit of Middleton as of Heywood; and it was rather late in the day for them to suggest such an alteration as this. However, they had not attacked the reason for the loan, and had only dealt with the union between the two towns; and therefore he suggested that Heywood had a fair case. This concluded the inquiry.

Incandescent Gas Lighting at Princes Risborough.—Some time ago, the Princes Risborough Parish Council adopted the Lighting and Watching Act, with the view of seeing what could be done in the improvement of the public lighting. The Chairman (Mr. L. Jaques) and other members of the Council conferred with the Directors of the Princes Risborough Gas Company (represented by Mr. G. Lane), who fully explained the incandescent system, with the result that it was decided to adopt it; and on Thursday last the town was lighted. The weather was unfavourable—the wind blowing strongly and rain falling; but, owing to the excellent condition of the lanterns, the lights were perfectly steady. The whole of the arrangements were under the superintendence of Messrs. W. T. & A. G. Lane, of the Aylesbury Gas-Works.

The Proposed Purchase of the Torquay Watersheds.—The resolution of the Torquay Corporation to promote a Bill for the purchase of the watersheds of the Trenchford Valley and the Kennick and Tottiford reservoirs, has already come before the Town Council for formal confirmation. In answer to a question, the Mayor (Mr. J. F. Rockey) said that if the Bill to be promoted were passed, the Corporation would not be compelled to purchase the whole of the lands described in the advertisement; they could take only such portion as might be deemed necessary. Mr. W. Beavis, who had asked the question, characterized the answer as quite satisfactory. Mr. R. Crocker, however, expressed regret that the watershed scheme had again been "thrust upon the town," which he believed was as strongly adverse to the proposal as it was two years ago. Alderman T. Harrison said he was in favour of the acquisition of the Trenchford Valley and Brook, but not of the rest of the scheme. When the resolution was put, he abstained from voting. Of the other members present, ten voted for the resolution and three against it.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Falkirk is one of the most go-ahead of all Scotch towns. It has been famed for more than a century for its iron-works; but it is only of late years that it has assumed importance as a municipality. Its first step forward was the formation of a Water Trust, about eight years ago; and its next was the acquiring of the gas undertaking, two years ago. Whether these movements were the outcome of a quickened municipal life, or were the cause of it, I do not stay to inquire; but since they were taken, it is an undoubted fact that the town has grown greatly in bulk and in prosperity. Both the water and gas undertakings have required enlargement since they became Corporation property. For the water undertaking, an Act of Parliament was procured last year, authorizing extensions, which consist of the taking in of more water in the gathering ground, the construction of additional filters at Little Denny, and the laying of a new pipe-track from there to the town. The Gas Commissioners also proceeded, under their own powers, to erect a new gasholder.

Of the water scheme, the filters have been completed, and the new pipe-track is all but so; and the Gas Commissioners have erected their holder. Both schemes being at the stage when they could be brought into use, the Water Trust and the Gas Commission agreed to hold a mutual inauguration day. This was fixed for Thursday; and I was privileged with an invitation to attend, which I accepted, and was only sorry that, on account of business elsewhere, I was not able to be present during the whole time. The proceedings began at eleven in the forenoon, when a party of about 100 gentlemen drove out to Little Denny, about six miles distant, and turned the water on to the filters. I was not present at this ceremony; but I have learned that what took place was that, on arriving at the end of their journey, the company went to the Little Denny reservoir, which they inspected, and found everything to be in order. They then proceeded to the new filters. These are each 80 ft. long by 45 ft. broad, and 6 ft. deep. They are built of concrete; and the filtering material consists of Caithness pavement resting on bricks, surmounted by a layer of broken whinstone 18 inches in thickness, above which is a 6-inch layer of gravel, a layer of perforated tiles, with 60 holes per square foot, and on the top a layer of iron sand 2 feet in thickness. The filters are intended to deal with 756,000 gallons of water per day. The cost of them has been about £2000; and the total outlay incurred, including the price of land and the laying of the new pipe-line to the town, has been about £15,000. The whole work has been executed by Messrs. Stark and Son, of Kilsyth and Glasgow, to plans and specifications prepared by Mr. W. W. Neilson, the Engineer to the Trust. Mr. J. Watson, of Bradford, who is Consulting Engineer to the Trust, in the name of Mr. Neilson and the Contractors, presented Provost Weir with a beautiful silver key, in the form of a wheel, with a gold centre, with which to turn on the water. This having been done, Provost Weir said that six years ago, when they introduced the water system, they considered that it was complete; but the population of the town and district had increased to such an enormous extent, that they found it absolutely necessary that they should have more water. This was the first instalment of the scheme of enlargement which they were carrying out; and if Falkirk went on increasing as it had been doing, it would not be very many years before they would require a further extension.

The party then returned to the town. As they entered the burgh, they alighted at the new gasholder, which has been erected on ground which the Commissioners have purchased at Parkhouse. In acquiring this land, the Gas Commissioners exercised very wise and commendable forethought. When the undertaking of the Gas Company was taken over, the works of the Company were situated at two different places. One of the works was small, and almost worn out. The Commissioners sold them, and concentrated their business at the other. But those works are so hemmed in between a public road and a canal, that there is no room for extending them; and in view of the great increase in the consumption of gas which has already, and which is expected yet to take place, the Commissioners resolved to acquire a site to which they might remove the entire works whenever this might be necessary. About five acres of land have accordingly been bought at Parkhouse, at a cost of a little over £5000. It is situated immediately to the north of the railway which runs from Grahamston to Larbert, a short distance to the west of Grahamston station. On the other side of the ground is the canal; and a railway siding already bounds the east of it, from which a siding could be run into the works. A more ideal spot for a gas-works could scarcely be procured. The new holder has been erected in the south-western corner of the plot. Travellers by the railway between Grahamston and Larbert can easily see the holder—I was assured so yesterday by a gentleman who had passed the place, and whose attention was attracted to it on account of its unusual appearance—and it is on account of the, as yet, novelty of the holder, that I am particular in indicating where to look for it. The peculiarity of the holder is that it is constructed on the columnless principle; and it is the first of the kind built in Scotland. When the Commissioners had made up their minds that a new holder was requisite, and before they could get the necessary negotiations completed, the time was short in which to have it erected for use this winter season. That was one reason (though there may have been others) why, when they came to decide as to the design of the holder, they chose the wire-rope guided system patented by Messrs. Ashmore, Benson, Pease, and Co., of Stockton-on-Tees. The foundation for the tank was prepared by workmen under the direction of Mr. P. B. Watson, the Gas Manager at Falkirk; but otherwise the holder has been erected by the patentees. It stands entirely above ground. The subsoil is variable in the locality; but where the holder stands it is, at no great depth, bastard clay, and not very suitable for excavation. The tank rests upon a bed of concrete 2½ feet thick. The holder and tank are of steel. The tank is 135 feet in diameter, and 21 feet in height. At present, the holder is a two-lift one; but all the necessary fittings have been placed in position for the addition of a third lift, outside the existing lower one. The present lower lift is 132 feet in

diameter, and 20 feet in height. The capacity of the holder, as it stands, is a little over 500,000 cubic feet. The wooden framing on which the holder was built has been left inside. The crown is an untrussed one; and, with the exception of the two outer rows, the sheets are square. There are circular cups and dips; and the rope supports are eight in number, equi-distant. The ropes are ⅝ inch diameter, of steel wire; the system of applying them being the last pattern adopted by the builders under their patent. Round the top of the tank a platform 3 ft. 9 in. in width, with a hand-rail, has been built, access to which is had by a wooden staircase. As showing one advantage of this system of gasholder construction, I may mention that the contract was entered into in June; and the erection of the ironwork was begun about Midsummer day. The whole structure has therefore only taken 5½ months to erect. The total cost will be about £6500, which is claimed to be considerably less than would have been the case had guide-columns been used.

At the inaugural ceremony, Mr. R. Seymour Benson presented Bailie Hamilton, the Convener of the Works Committee of the Commission, with a silver and gold key (upon which there appears a representation of the holder and a suitable inscription), with which to open the valve allowing the gas from the holder—which, by the way, had been already about three-quarters filled—to pass to the town. Bailie Hamilton expressed the pleasure he had in performing the duty which had fallen to him—the inauguration of the first holder in Scotland built on the wire-rope system. The necessity for a new holder, he said, was very great. When they took over the undertaking of the Falkirk Joint-Stock Gas Company, they were sending into the town about 64 million cubic feet of gas a year; and at the present time their consumption was over 80 million cubic feet a year. Another fact he might mention, to show the necessity for the holder, was that their storage capacity was about 400,000 cubic feet, whereas they were sending into the town about 600,000 cubic feet per day. This showed that they had been none too soon in erecting the holder. The valve was then opened, after which the company were invited to inspect the holder. Nearly all of them went up and walked round on the platform on the top of the tank; and a few ventured to the top of the holder, to see how the ropes were placed. The company then drove into the town, and sat down to dinner in the Crown Hotel. A considerable time was occupied in the disposal of a long list of toasts—seventeen in number.

I have received from Mr. R. S. Carlow, of Arbroath, the Hon. Secretary, a copy of the "Proceedings at the Thirty-fifth Annual Meeting of the North British Association of Gas Managers," held at Edinburgh on July 22 and 23 last. The report, to which is added the Statistical Report of the Gas Supply of Scotland from July 31, 1895, to Aug. 1, 1896, is a valuable production, and reflects great credit on Mr. Carlow, upon whom its compilation must have entailed a great amount of labour.

The small but noisy group of Stirling citizens who oppose the proposed transfer of the Gas Company's undertaking to the Corporation, would seem at present to have rather set back the movement. The Police Commissioners held a special meeting on Friday of last week, to consider a letter from the Directors of the Gas Company, in which the Commissioners were informed that the Company had no desire to force in any undue way the sale of what they considered to be a sound and remunerative property, and were asked to submit a formal offer. There was read a minute of the Gas-Works Committee of the Commissioners, recommending that an offer be made to the Directors of £61,130—being the valuation of Mr. M'Gilchrist—and on the conditions contained in the report. Councillor Govan, Convener of the Committee, moved the adoption of the recommendation, which was seconded by Treasurer Colquhoun. Bailie Wingate moved that, in consequence of the generally expressed opposition of the community, and particularly of the ratepayers of the burgh, to the proposed purchase of the gas-works, the Commissioners resolve that the works be not purchased by them, and that all further conferences and negotiations with the Directors be abandoned in the meantime. Councillor Allan seconded. After a long discussion, the vote was taken, when ten voted for the motion, and nine for the amendment. The report which I am working from adds that "in reply to a Commissioner, who asked whether Provost Kinross and Councillor P. Macfarlane, who are Directors of the Gas Company, and Councillor D. Bayne, who is a shareholder, could vote on the question, the Clerk read an opinion to the effect that they were entitled to do so. It was accordingly by their votes that the motion was carried." The last sentence shows the spirit in which the matter is regarded by some of the influential local people. There is no need for yet giving up all hope of an amicable agreement being come to. On the part of the Gas Company, there seems to be a spirit of fairness, which should assist in coming to terms. There was a special meeting of the shareholders on Tuesday, which was called to consider the offer by the Corporation of £61,130 for the undertaking. Of course, the proceedings were held in private; and only the result has been announced. This was to have the works valued by Mr. Andrew Gillespie, of Glasgow, and to hold another meeting to consider his report, when received. Mr. Gillespie has undertaken the work; and he entered upon his duties yesterday.

A fire occurred in the Stirling Gas-Works last Saturday night, which considerably alarmed those in charge. Flames from the retort-mouth ignited the oil in a tank above, and there was a threatening blaze for a little; but the fire was got out before much damage was done. Oil-tanks should be always kept well away from the retort-benches. In some instances, when the oil process was first introduced, they were placed too near; but I thought that they had all been made safe by this time.

It is reported that Mr. J. M'Cubbin, the Manager of the Port Glasgow Corporation Gas-Works, has resigned his post, but that the Gas Committee have been requested to meet with him, and endeavour to get him to reconsider his decision.

The Perth Town Council met on Thursday night to consider the Bill which they are promoting in Parliament. The Committee in charge of the Bill reported that they had added a new clause, to make it lawful for the Gas Commissioners to set apart a sum of £500 per annum for contingencies, depreciation of works, and any probable outlays for improvements. Bailie Wright, the Convener of the Works Committee of the Gas Commission, said it was impossible to tell, as yet, how much they would probably expend upon the gas-works, because they had not made up their minds as to the system of retorts they were to adopt. There was a difference of something like £3000 or £4000 between the systems they were considering. In round figures, however, including the holder that was being erected, he thought that not more than £40,000 would be required; and the saving in the removal of the works, and in the plant they were likely to adopt, would be sufficient to meet the interest on money borrowed, and to lay aside the necessary instalments for the repayment of the principal. It was resolved that the cost of the Bill shall be borne, to the extent of one-quarter each by the Police Commission and the Town Council, and to the extent of one-half by the Gas Commission.

The costs of the Dunfermline Gas Company in the recent arbitration proceedings were before the Auditor of the Court of Session on Wednesday. The total sum is said to have amounted to over £2000; but the Auditor struck off about £1000, which will, of course, have to be borne by the Company. In particular, a fee to Mr. J. A. Robertson, of Edinburgh, whom the Company employed to make up a statement of their accounts, but did not put into the witness-box, was disallowed; and the fees to Mr. Asher, Q.C., the Senior Counsel for the Company, were cut down from 50 to 25 guineas a day. The fees of a number of the witnesses were also considerably curtailed. The accounts of Mr. W. Reid, Solicitor, the Clerk to the reference, were submitted on the same day to the Auditor for taxation. No objection was taken to any of the items; and his account will therefore be paid in full.

A public meeting was held in Dumfries on Tuesday night, to consider the provisions of the new Water Bill which is being promoted for the district. Provost Glover presided. Mr. J. H. M'Gowan, the Clerk to the Water Commission, stated that their existing Act was antiquated. It declared that the water supply was for the burghs of Dumfries and Maxwelltown, and the suburbs; but the limits of the Act were to be the parliamentary boundaries, so that it was difficult to see how suburbs beyond the boundary could be supplied. Nevertheless, pipes had been laid and supplies given; and such success had attended this policy that the public water-rate had been reduced from 6d. to 1d., and the domestic rate from 6d. to 3d. per pound. They had, however, been confined in their action by the provisions of the Act; and they proposed to take powers to supply water to all places adjacent. They also proposed to extend the qualification for voting, from a £10 rental to all who were rated for water; and that, instead of open voting, the elections should be by ballot, as in municipal elections. The constitution of the Commission was to be ten members elected by the Corporations of Dumfries and Maxwelltown, and six elected direct by the ratepayers. Some exception was taken to this proposal; and it was, in the end, agreed to make a recommendation to the Committee who are attending to the Bill, to consider whether the whole of the Commissioners should not be elected by the ratepayers direct. The Bill was then approved of.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 12.

Sulphate of Ammonia.—There has been nothing special to comment upon; the market having been quiet, but with a slight improvement at Leith at the close. There has again been a fair inquiry. But consumers' ideas have mostly been below current prices; and consequently only a very moderate amount of direct business has resulted. Dealers, who have been very quiet lately, have come more into view within the last day or two, and they have removed most of the second-hand stuff. Their operations have, however, been mainly in Scotland, where, in the early part of the week, as low as £7 5s. was being taken f.o.b. Leith, and where up to £7 7s. 6d. per ton has been paid to makers. Closing quotations are £7 7s. 6d. f.o.b. Hull and Leith, and £7 7s. 6d. to £7 8s. 9d. f.o.b. Liverpool. In the forward position, makers, looking for a decided improvement next year, remain firm. Speculators have, however, been offering on the Continent December-January at spot prices, but without much success; and, although they have been willing to accept a moderate premium for spring months, buyers—afraid of being again caught—have not responded.

Nitrate of Soda presents no new feature; and the spot price remains at 8s. per cwt. for fine quality.

LONDON, *Dec.* 12.

Tar Products.—This market is, generally speaking, dull, and in some particulars distinctly flat. Benzols still proceed on their downward course, and reflect themselves in the other light tar products. A good deal more is being done in creosote and tar oils, all of which are in better request than for some months past, during which distillers had accumulated large stocks. Carbolic acid maintains its firmer value; but crude still continues out of parity with crystals. There is a little more inquiry for anthracene; but buyers are all expecting to purchase at lower prices than quoted by the Committee.

The average prices obtainable during the week have been: Tar, 18s. to 25s. Pitch, 25s. to 28s. Benzols, 90's, 3s.; 50's, 2s. 6d. Solvent naphtha, 1s. 6d. Crude, 30 per cent., naphtha, 1s. 2d. Creosote, 1¾d.; liquid, 2¼d. Heavy oils, 45s. Naphthalene, 62s. 6d.; salts, 30s. Cresylic acid, 10d. Carbolic acid, 60's, 2s. 1½d. Anthracene, nominal, "A," 9d. to 10d.; "B," 7½d. to 8½d.

Sulphate of Ammonia at the moment occupies the anomalous position of being shipped very freely, and being in good inquiry without any effect upon its value. It is satisfactory, however, to know that during the week no further recession in price has taken place, while it is generally admitted that the near future must see some advance. Indeed makers are all asking more money for January delivery. There is no change in price, which remains at £7 7s. 6d. to £7 12s. 6d., less 3½ per cent., according to port of shipment.

Proposed Gas-Works at Box.—A movement is on foot at Box for the purpose of forming a Gas Consumers' Company, with works in the town.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The position in the coal trade here shows no appreciable change; a fairly active demand being reported generally, with pits kept on practically full time, and prices firm at recent rates. Best Wigan Arley is quoted at 10s. 6d. to 11s. per ton at the pit; and for Pemberton four-feet and seconds Arley, 8s. 6d. to 9s. Steam and forge coals are in good demand; and there is now scarcely any excess of supplies over requirements, with 6s. 6d. per ton at the pit, about an average figure for ordinary qualities. Engine fuel is gradually becoming more plentiful in the market, with some sorts accumulating slightly in stock; but prices are steady at late rates. Small advances are, however, asked on forward contracts. Steam coal is in brisk demand for shipment, with the recent improvement in selling prices fully maintained; ordinary qualities, delivered at the Mersey ports or on the Manchester Ship Canal, readily fetching 7s. 9d. to 8s. 3d. per ton.

Northern Coal Trade.—There is a rather more decided improvement in the coal trade of the north-east this week, as is not uncommon before the holidays. Best Northumbrian steam coals are in fuller demand; and some producers ask a higher price in consequence. Thus the quotation for this class of coals must be now put at from 7s. 7½d. to 7s. 9d. per ton f.o.b.; second qualities ranging from 7s. to 7s. 3d. In the Durham coal trade, there is much greater activity; the gas coal collieries being now taxed to the utmost to meet the requirements of the large contracts that they have, and to allow a little margin for casual sales. In the latter case, very high prices are now asked; and 7s. 6d. per ton has been paid for a cargo of best Durham gas coals. Manufacturing coals show no alteration. Gas coke is in very large production, and is unaltered in price this week.

Scotch Coal Trade.—The coal trade continues active in all departments. There is a large output, and a ready demand for home consumption. Coalowners looked on with interest at the difference with the railwaymen in England; knowing that if a strike occurred there would be a great diversion of coal traffic to Scotland, and a smart rise in prices. According to the latest reports, this expectation is gone. What is now to be looked to is the development of the foreign trade. Unless this can be accomplished, there is little hope of prices advancing. The Fife and Lothian districts depend mostly upon export; and it is there that the pinch is felt by coalmasters, who have, in consequence, been unable to give the 6d. per day of increased wages which the miners asked, and which has been conceded in the West of Scotland. The labour leaders are endeavouring to persuade the men to demand an advance, and have got the length of inducing them to take an idle day here and there; but taken generally, the men are working steadily, and are likely to do so. The greatest danger of their not continuing to do so, lies in the fact that those "leaders," who have been at sixes and sevens since the last strike, appear to have laid aside their differences, and are working in harmony again. The prices quoted are: Main, 6s. 9d. (firm) per ton f.o.b. Glasgow; ell, 7s. to 7s. 3d.; and splint, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 137,345 tons—a decrease on the preceding week of 31,361 tons, and the corresponding week of last year of 7650 tons. For the year to date, the total shipments have amounted to 7,247,078 tons—an increase over the same period of last year of 181,846 tons.

Accrington's Water Supply.—In accordance with instructions Mr. C. Harrison, the General Manager for the Accrington and District Gas and Water Board, has prepared a report on the water supply for submission to the members. It is pointed out that, owing to the undermining by reason of the collieries in the neighbourhood, and also to having a subsoil of almost impermeable clay, a large capital outlay has been necessary for the construction of storage reservoirs for the impounding of rain water falling on the surface of the watershed; the clayey subsoil enabling them to avail themselves of some 60 per cent. of the total quantity. The Board possess three large storage reservoirs, with a total capacity of 527 million gallons; and three service reservoirs, holding in the aggregate about 24 millions. The area of supply is nearly 19 square miles; and the population is about 72,000. There are 50 miles of mains and 301 water-meters in the district; the supply equalling 21 gallons per head per day for all purposes for 70,000 people. The quantity used through meters for trade purposes last year was 147,149,900 gallons, about 400,000 gallons daily, equal to 5·7 gallons per head; for domestic use, the consumption was only 15·3 gallons per head. Including Accrington and Church, however, the quantity per head per day for 48,000 consumers equals 25 gallons for all purposes. Mr. Harrison suggests certain improvements for the prevention of waste, and the increase of the storage capacity of one of the reservoirs, at a cost of about £4000.

Periodical Stoppages in the "Constant" Supply of Water at Salisbury.—The city councillors of Salisbury appear to expect too much from their water-works and those who have to manage them under somewhat onerous conditions. Some time ago, the Corporation determined to give the inhabitants a constant supply of water; and they also decided to put in a new engine at the works at a cost of £5000. This engine, and the boiler and pipes in connection with it, after running about four months, in the ordinary course of things, required cleaning; and, with only the present small staff of three men, this occupied nearly a month to carry out. For some reason or other, there exists a necessity for the supply of 60 gallons of water per head per day. This quantity the new engine is capable of supplying, but the old engine can only deliver 40 gallons per head per day; so that, while the new engine is being cleaned, the water has to be cut off at night time. This caused complaint at the last meeting of the Council; and the Assistant Surveyor explained the position of affairs. He also pointed out that at most water-works there were two engines which could be worked in duplicate, so that, when one needed repair or cleaning, the other could be utilized. Further, he had only one boiler to work the new engine; and it took some time to clean this out and give it proper time to cool down. Some of the councillors ventured to express the hope that the Water Committee would give the matter their very serious consideration.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 1175.)

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	23—25	..	4 4 0
100,000	10	"	7½	Do. 7 p. c.	17½—18½	..	4 1 1
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	107—110	..	4 10 11
200,000	10	29 Oct.	5	Belgrano (B. Ayres), Limited	10¼—11	..	4 10 11
100,000	Stck.	26 June	5	Do. 5 p. c. Deb. Stk	104—107	..	4 13 5
200,000	5	12 Nov.	6½	Bombay, Limited	7⅞—8½	+¼	3 18 9
40,000	5	"	6¼	Do. New, £4 paid	5¾—6¼	..	4 3 2
380,000	Stck.	13 Aug.	12	Brentford Consolidated	285—290	..	4 2 9
210,000	"	"	9	Do. New	215—220	..	4 1 9
50,000	"	"	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	"	11 Dec.	4	Do. 4 p. c. Deb. Stock.	130—134*	+2	2 19 9
220,000	Stck.	16 Sept.	11½	Brighton & Hove Original	242—247	..	4 13 1
208,820	"	"	8½	Do. A Ord. Stk.	185—190	..	4 9 5
933,500	Stck.	28 Aug.	5	Bristol, 5 p.c. max.	127—132	..	3 15 9
420,000	20	15 Oct.	11½	British	56—57	+½	3 18 11
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	22—23	..	5 0 0
71,000	10	"	8½	Do. 7 p. c.	19—20	..	4 5 0
500,000	10	15 Oct.	6	Buenos Ayres (New) Limited	10½—10⅝	..	5 11 8
200,000	100	1 July	6	Do. 6 p. c. Deb.	103—105	+½	5 14 3
150,000	20	15 July	8½	Cagliari, Limited	29—31	..	5 6 5
100,000	10	30 Sept.	6	Cape Town & District, Ltd.	16½—17½	..	3 8 8
50,000	50	3 Nov.	6	Do. 6 p. c. 1st Mort.	57—59	..	5 1 8
550,000	Stck.	15 Oct.	13½	Commercial Old Stock	338—343	..	3 18 8
165,000	"	"	10⅝	Do. New do.	255—260	..	4 0 9
165,000	"	11 Dec.	4½	Do. 4½ p. c. Deb. do.	150—155*	+½	2 18 0
800,000	Stck.	12 June	13	Continental Union, Limited.	270—275	−2	4 14 6
200,000	"	"	10	Do. 7 p. c. Pref.	220—225	..	4 8 11
51,600	Stck.	28 Aug.	14	Croydon Com'cial A 10 p. c.	315—320	..	4 7 6
163,400	"	"	11	Do. B 7 p. c.	250—255	..	4 6 3
535,000	Stck.	28 Aug.	5½	Crystal Palace Ord. 5 p. c. Stk	140—143	..	3 13 5
60,000	"	"	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,090	10	15 July	11	European, Limited	26—27	..	4 1 6
354,060	10	"	11	Do. £7 10s. paid	18—19	..	4 6 11
5,746,590	Stck.	13 Aug	12¾	Gaslight & Coke, A, Ordinary	310—315	−2	4 0 11
100,000	"	"	4	Do. B, 4 p. c. max.	110—115	..	3 9 7
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	305—315	..	3 3 6
30,000	"	"	5	Do. F, 5 p. c. Prf.	147—152	..	3 5 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	212—217	..	3 9 1
1,300,000	"	"	7	Do. H, 7 p. c. max.	207—212	..	3 6 0
463,000	"	"	10	Do. J, 10 p. c. Prf.	305—315	..	3 3 6
476,000	"	"	6	Do. K, 6 p. c. Prf.	172—177	..	3 7 10
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	137—142*	+1	2 16 4
294,850	"	"	4½	Do. 4½ p. c. do.	150—155*	+2½	2 18 0
908,000	"	"	6	Do. 6 p. c. do.	203—208*	+1	2 17 7
70,000	10	29 Oct.	6	Hongkong & China, Limited	12—13	..	4 12 4
3,800,000	Stck.	12 Nov.	12	Imperial Continental	215—220	+3	5 9 1
376,400	100	1 Aug.	4	Do. 4 p. c. Debs. Red.	100—103	..	3 17 8
473,600	Stck.	13 Aug.	3½	Do. 3½ p. c. Deb. Stk	108—110	..	3 3 8
75,000	5	11 Dec.	6	Malta & Mediterranean, Ltd.	6—6¼*	+¼	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	111—115	..	4 6 11
250,000	100	"	4½	Do. 4½ p. c. Debs.	108—110	..	4 1 10
541,920	20	12 Nov.	5	Monte Video, Limited	16—17	..	5 17 8
150,000	5	26 Nov.	8	Oriental, Limited	8½—9	..	4 8 11
135,000	5	"	8	Do. New, £4 10s. paid	7⅞—8	..	4 10 0
15,000	5	"	8	Do. do. 1879, £1 paid	1¾—2	..	4 0 0
60,000	5	16 Sept.	7	Ottoman, Limited	5—5¼	..	6 7 3
420,000	100	2 Nov.	6	People's Gas } 1st Mtg. Bds.	102—107	..	5 12 1
500,000	100	1 Dec.	6	of Chicago } 2nd Do.	100—105	..	5 14 3
250,000	10	30 Sept.	10	San Paulo, Limited	13—14	..	7 2 10
5,475,000	Stck.	13 Aug.	5 2/10	South Metrop., 4 p.c. Ord.	145—149	+1	3 9 9
820,000	"	15 July	5	Do. 5 p. c. Deb. Stk.	171—174	..	2 17 6
60,000	Stck.	16 Sept.	11½	Tottenham & Edmonton, A	270—280	..	4 2 3
60,000	"	"	8½	Do. B	180—190	..	4 9 5
170,380	10	29 May	10	Tuscan, Limited.	14—15	..	6 13 4
149,900	10	1 July	5	Do. 5 p. c. Debs. Red.	101—103	..	4 17 1
				WATER COMPANIES.			
746,123	Stck.	26 June	10½†	Chelsea, Ordinary	338—343	..	3 1 3
150,000	"	"	5	Do. 5 p. c. Pref.	177—182	..	2 14 11
160,000	"	"	4½	Do. 4½ p. c. Pref. Stk., 1875	160—164	..	2 14 10
175,785	"	30 Sept.	4½	Do. 4½ p. c. Deb. Stock	162—167	..	2 13 11
1,719,514	Stck.	15 Oct.	7	East London, Ordinary	230—235	..	2 19 7
554,740	"	26 June	4½	Do. 4½ p. c. Deb. Stk.	163—168	..	2 13 7
225,000	"	"	3	Do. 3 p. c. Deb. Stk.	105—107	..	2 16 1
700,000	50	11 Dec.	7½	Grand Junction, 10 p.c. max.	117—122*	+3½	3 1 6
295,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	150—155	..	2 11 7
708,000	Stck.	13 Aug.	12	Kent	335—345	..	3 9 7
160,000	"	"	7	Do. New, 7 p. c. max.	215—220	..	3 3 7
1,043,800	100	26 June	9½†	Lambeth, 10 p. c. max.	273—278	..	3 8 4
406,200	100	"	7½	Do. 7½ p. c. max.	225—230	..	3 5 2
350,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	150—153	..	2 12 3
500,000	100	13 Aug.	12 9/10	New River, New Shares	418—423	..	3 1 0
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk.	150—155	..	2 11 7
902,300	Stck.	12 June	6†	S'thwk & V'xhall, Ordinary	152—157	..	3 16 6
126,500	100	"	6†	Do. Do. 7½ p. c. Max.	148—153	..	3 18 5
489,200	Stck.	"	5	Do. Do. 5 p. c. Pref.	175—180	..	2 15 6
1,019,585	"	30 Sept.	4	Do. 4 p. c. A Deb. Stk.	148—152	..	2 12 7
1,155,066	Stck.	11 Dec.	10	West Middlesex	310—315*	..	3 3 6
200,000	"	"	4½	Do. 4½ p. c. Deb. Stk.	163—168*	+½	2 13 7

† Next dividend will be at this rate. *Ex div.

Reduction in Price.—The Directors of the Castle Donington Gas Company, Limited, have decided to reduce the price of gas from 5s. to 4s. 2d. per 1000 cubic feet as from the 1st prox.

A New Reservoir for Horwich.—The Horwich District Council have approved of plans and estimates, prepared by their Surveyor (Mr. J. E. Jackson), for a reservoir of 20 million gallons capacity.

The St. Anne's Gas-Works Purchase Question.—At last week's meeting of the St. Anne's District Council, a petition against the proposed compulsory purchase by that authority of the local gas-works was received; the document having been signed by a number of the property-owners in the district. The Council decided to proceed with the purchase; and a Sub-Committee was appointed to carry out details. Several members expressed the hope that the Gas Company would recognize the position, and agree to sell; thus saving considerable expense to both sides.

Kirkby Lonsdale Gas-Works Purchase Question.—Writing on the subject of the proposal of the Kirkby Lonsdale District Council to purchase the undertaking of the Gas Company, one of the officials of the Local Government Board says it does not appear to that body that "the powers which the District Council might obtain by a Provisional Order for the purchase of the gas-works, and the subsequent carrying on of the gas undertaking, would suffice to enable them to supply, in the manner contemplated, premises situate beyond their district." On the letter coming before the Council, it was agreed to send a copy to the Company, and inquire whether or not they were willing to sell the works without taking into account the supply of Casterton.

Gas-Meter Rents at Accrington.—The subject of the abolition of gas-meter rents was discussed at the meeting of the Accrington Town Council yesterday week. A proposition was introduced to the effect that the District Gas and Water Board should be asked to cease charging for the use of meters as soon as their finances would permit; and it was mentioned that this would be equivalent to reducing the price of gas ½d. per 1000 cubic feet. The Chairman of the Board (Alderman Haywood) stated that the matter had already been under consideration; and they were quite prepared to abolish the rents "as soon as possible." This would not satisfy the majority of the Council; and an amendment was carried calling for the immediate discontinuance of the rents.

Fatal Explosion of Acetylene in Berlin.—A terrible explosion, attended with fatal results, occurred last Saturday afternoon in the Moabit quarter of Berlin. It appears that for some time past a man named Georg Isaac had been prosecuting chemical researches, especially in connection with the manufacture of acetylene gas. His experiments had attracted considerable attention; and it was reported that the Emperor purposed visiting the laboratory. The origin of the disaster cannot be accurately known, for Isaac and his three assistants were killed. The violence of the explosion was so great that nearly all the windows in the building where the laboratory was situated were shattered; while the bodies of the unfortunate men were found blown to pieces.

The Charge for Water for Gardens.—A meeting of ratepayers in Lambeth and Camberwell was held a few days ago, in the large hall of the Camberwell Public Baths, "to protest against the overcharges of the South London Water Companies," and especially against the charge for water for gardens. Mr. T. Gautrey presided. The Chairman said that he and other residents in the district had received from the Southwark and Vauxhall Company, in their last demand note, a call for 4s. for garden watering, which had not hitherto been charged. This demand was made even in the case of houses which had only four or five yards of "back" paved over; and it was made notwithstanding the fact that in many other cases the house would let for £4 or £6 less without the garden, so that the supply was already being paid for. If the water undertakings were purchased by the public, it seemed probable that the price would amount to 35 years' purchase, so that the charge would amount, on the 40,000 assessments in Camberwell alone, to an increase of £25,000 in the capital sum which would have to be paid by the ratepayers. He had refused to pay the charge; and he believed that, where no special apparatus was used for watering the garden, no demand could be legally made. Mr. S. Coward, the Secretary of the Bath Tax Abolition Committee, moved a resolution calling on consumers to resist "all attempts to increase the present exorbitant charges for water," and calling on Parliament to enable the public authorities to provide a competing supply. This was carried; and it was ordered to be sent to the Government, the County Council, and the various Local Authorities.

East Stonehouse Water Supply.—The East Stonehouse District Council confirmed on Tuesday last the decision of a previous private meeting, at which it was determined to apply for a Provisional Order varying the Council's statutory powers in the matter of water supply. Under existing Acts of Parliament, the Plymouth Corporation are bound to give the township of East Stonehouse a continuous supply of water from the year 1898; and provision is made that the supply shall be taken direct from the Corporation's high-level service reservoir at Hartley. In view, however, of the heavy cost of laying and maintaining a pipe to the reservoir, it is proposed to enter into an arrangement with the Corporation to take the supply from the Corporation mains at the boundary of the borough and township. Stonehouse is to pay to Plymouth £200 per annum for this convenience—a sum which is to be reduced to £150 per annum at the end of thirty years. The connection is to be made in a manner to be agreed upon by the Water Engineers of the two bodies, or, failing agreement, by an Engineer appointed by the Local Government Board. The Chairman of the District Council (Mr. S. Vosper) expressed the opinion that this was the best arrangement that could be made in the interest of the township. Mr. T. W. How dissented, on the ground that they were departing from a principle under which the water-works would ultimately become free from debt. By the proposed arrangement, they were binding themselves and their successors to the payment of the £150 in perpetuity. The Chairman put an end to discussion with the remark that the only matter before the meeting was that of the accuracy of the record of the previous meeting, which was not questioned.

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WARRINGTON & LONDON.

DOWN DRAUGHTS PREVENTED.
UP DRAUGHTS CREATED.

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NO SMELL ON FIRST LIGHTING GAS-FIRES.

No Contamination of the Air.

Essential in all Sick Rooms—Especially Bronchial Cases.

Gas-Fires are often objected to on account of the disagreeable Products of Combustion escaping into the Room immediately after lighting.

The absence of an Up-Draught in the Flue or Chimney causes this.

The Patent Improvements consist in affixing a Bunsen Burner at the **Flue opening**, for the purpose of producing an **Up-Draught. A removable Cap** is arranged in the Canopy. After lighting the Bunsen Burner, the Gas-Fire may be lit in two minutes.

APPLIED TO ALL SIZES OF

"RICHMONDS,"
"GORDONS,"
"MAGNETICS,"
"BRITANNICS,"

AT 10s. EACH EXTRA.

The South Molton Corporation and the Gas-Works.—The South Molton Town Council have accepted an offer of the Huddersfield Corporation to lend £3330 for the purchase of the gas-works, at 3½ per cent., principal and interest to be repaid in twenty annual instalments.

The Deal and Walmer Water Board.—The difficulties which have beset the question of how the Councils of Deal and Walmer could best amalgamate in purchasing the undertaking of the Deal Water Company appear to be settled; it having been arranged that the Joint Board of Management shall consist of twelve members—six being chosen from each town.

The Public Lighting of Morecambe.—The Morecambe District Council are dissatisfied with the price charged for the gas used for the public lighting; and recently their Surveyor (Mr. Bond) wrote to the Manager of the Gas Company (Mr. W. Duff) with respect to a deputation from the Council meeting the Directors to discuss the matter. Thereupon Mr. Duff, acting upon instructions, requested that the proposals of the Council should be put in writing and submitted. Following this came a letter from Mr. Bond, in which it was stated that, inasmuch as, since the date of the agreement between the Council and the Company, the price of gas had been reduced to private consumers by 6d. per 1000 cubic feet, it was considered that the time had come when the Council should have the same, or even better terms than those offered to private persons. A scale was suggested, ranging from 3s. per 1000 cubic feet for an annual consumption of 2½ up to 3 millions, down to 2s. 3d. for 4 millions; the other terms and conditions of the agreement to remain unaltered. The Directors considered this proposal, and replied by submitting a scale upon the basis of which they would be prepared to enter into a fresh contract. According to this, the prices ranged from 3s. 5d. per 1000 cubic feet for an annual consumption of 3 millions, down to 2s. 6d. for 10 millions—the charge falling at the rate of 1d. for each half million extra consumption up to 7 millions, and then at this rate per million. The offer was not entertained; and six months' notice is to be given to the Company to determine the existing agreement.

Messrs. W. & B. Cowan, Limited, have removed their Manchester works from Dutton Street to Dalton Street, Newtown.

Messrs. H. Balfour and Co., of Leven, are erecting a gasholder of 30,000 cubic feet capacity, at Pitlochry. It will work in a steel tank 12 feet high, half of which is to be below the surface of the ground.

The London agents of the Johannesburg Water-Works, Estate, and Exploration Company publish the numbers of 96 debentures, amounting to £6000, which have been drawn for payment at £105 per cent. on the 31st inst.

The Directors of the Keswick Gas Company having decided to extend the system of generator firing put in at their works some time ago by Messrs. Jonas Drake and Son, of Halifax, have placed a further order with that firm.

The Directors of the Buenos Ayres (New) Gas Company give notice to holders of the 6 per cent. debentures that the half-yearly coupons due on the 1st prox. will be paid on and after that date by Messrs Prescott and Co., Cornhill.

Messrs. Le Grand and Sutcliff, of Bunhill Row, E.C., have just successfully completed, for the Chepstow Water Company, an artesian well, the bore-hole of which is yielding sufficient water of excellent quality for all present requirements.

Messrs. Clayton, Son, and Co., Limited, have commenced the construction of the new holder at the Sowerby Bridge Gas-Works. When it is finished, the total storage accommodation at the works will be equal to a day and a quarter's supply, based on the highest daily consumption.

The Secretary of State for Foreign Affairs has received a despatch from Her Majesty's Consul at Palermo, stating that tenders for the supply of drinking water to the town of Girgenti are invited by the Municipality. Copies of the official specifications have not yet been received; but the translation of an advertisement on the subject may be seen at the Commercial Department of the Foreign Office.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 65 095.

GWYNNE & CO.,
HYDRAULIC AND GAS ENGINEERS,
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.
Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

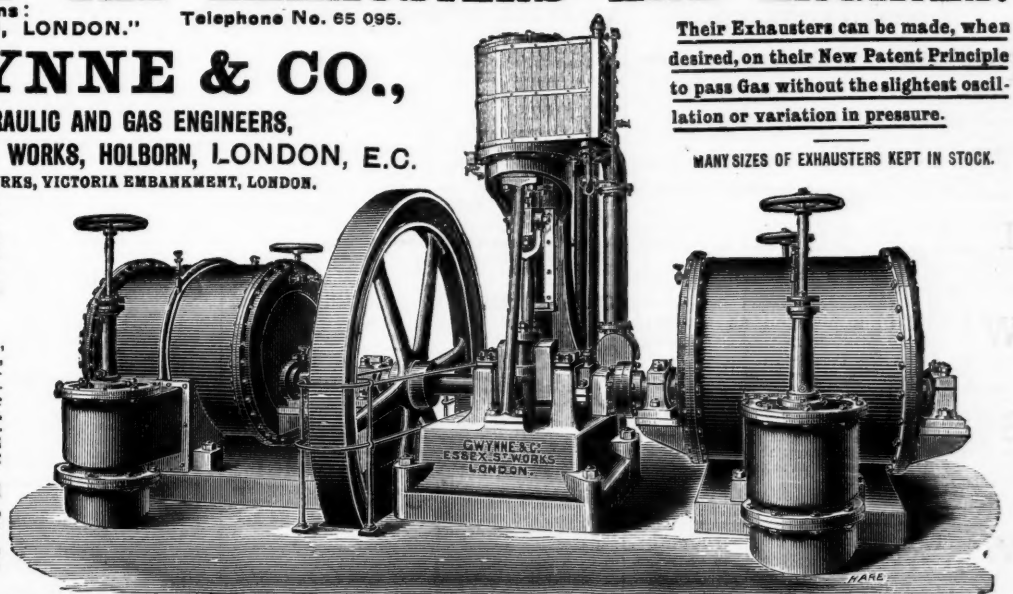
They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for TAR, LIQUOR, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.



Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

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Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
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WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. in use in most Continental Gas-Works, and in more than 300 British Gas-Works.
ANDREW STEPHENSON,
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OLD BROAD STREET,
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Telegrams: "Volcanism, London.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
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JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement see Dec. 1, p. 1050.]

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Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

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70, CHANCERY LANE, LONDON, W.C.

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BROTHERTON AND Co., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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BROTHERTON AND Co., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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TUBES for Gas, Steam, and Water (all Sizes), Welded or Riveted. TANKS, HYDRAULIC MAINS, RETORT-LIDS, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

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Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
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ECONOMY IN PURIFICATION.

INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
And J. EVERY & SON, Phœnix Iron-Works, LEWES.

TRAVELLER, with good connection among Gas Companies, is open to ENGAGEMENT on Jan. 1.
Address No. 2756, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a position as ordinary routine CHEMIST in Gas-Works. Five Years in London Works. Good Character.
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SITUATION wanted, by a competent "Three-Branch" PLUMBER. Constant Employment, rather than high Wages, required. Age 37; Single. Several Testimonials as to good workmanship, steadiness, and industry.
Address No. 2765, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for Three or Four Months, a young Man who can lay Mains and Services, and fix Meters. Wages 25s. per week.
Apply to J. LEE, Gas-Works, WIRKSWORTH.

WANTED, good Gas-Fitters (Stoves, Coin Meter Fittings, &c.)
Apply, by letter, stating Age, References, &c., to No. 2766, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good leading Stoker, used to Scoop and Shovel Charging and Regenerative Settings.
Apply, with Particulars, to the GAS MANAGER, CHELMSFORD.

WANTED, a Stoker to take charge of a small Gas-Works, read Meters, &c. Cottage on Works. State Age and Wages required.
Apply, by letter, to No. 2769, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a young Man as Improver to GAS-FITTING, &c. One who has had Two Years' Experience preferred.
Apply, with *copies* of Testimonials, and stating Age and Wages required, to the GAS MANAGER, UTTOXETER.

GAS MANAGER.

WANTED, a Manager to take charge of a Country Gas-Works, carbonizing about 1100 Tons of Coal yearly. House, Garden, Gas, and Coal found.
Applications, with Testimonials (not exceeding four), stating Salary required, to be sent to the undersigned on or before the 1st of January, 1897.
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SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making. Kerosene, &c.
Correspondence invited.
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JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
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For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
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For all Ammonia Joints.

In Paper Covers, Post Free 2s.

STEPHEN CARPENTER, late of the Bow Common Gas-Works, on the PURIFICATION OF COAL GAS BY LIME, &c., and the Method of Working Lime Purifiers so that the Lime may be used a second time, with a Description of a short Method of Working the Sulphur Test.
S. CARPENTER, "Ryde," Woodhouse Grove, East Ham, ESSEX; or of H. W. CARPENTER, 3, Bedford Villas, Carshalton, SURREY.

WORKS MANAGER.

WANTED, a thoroughly practical Man to take the MANAGEMENT of large Gas-Meter Making Works.
Apply, by letter, stating Salary required, to No. 2767, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a competent House Gas-FITTER, with practical Experience in Gas Main and Service laying and management of Out-door Labourers. Age not over 35.
Apply, by letter, stating Wages expected, and enclosing *copies* of not more than Three Testimonials or References, to No. 2768, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating Price per ton and quantity, No. 2747, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Surface Condenser, to replace Jet Condensers to two ordinary Compound Beam Engines, 180 indicated horse power.
Full Particulars on application to WILLIAM A. VALON, Corporation Engineer, RAMSGATE.

WANTED, Offers for the Numbers of the "Journal of Gas Lighting" and "Gas World," unbound, from 1887 to 1896 inclusive.
Apply, by letter, to No. 2770, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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GAS Plant, both new and second-hand, ready for delivery, including Retort-Fittings, Condensers, Exhausters, Scrubbers, Purifiers, Meter, Governor, and Gasholder. **Inquire Price and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

CROYDON COMMERCIAL GAS COMPANY.

FOR SALE—
Two HORIZONTAL ENGINES, by F. Horne, of London, fitted with Air-Pumps, for use with Surface Condenser. Cylinders 13½-inch Bore, and 22-inch Stroke.
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One EXHAUSTER for 50,000 cubic feet per hour, by Waller, of London, with 14-inch Inlet and Outlet Valves and Connections.
One EXHAUSTER, by Donkin, of London, 40,000 cubic feet per hour, with 16-inch Valves and Connections.
Two BYE-PASS GAS-GOVERNORS, complete.
One CORNISH BOILER, by Cochrane, Grove, and Co., 22 feet long by 6 feet diameter, with five Galloway Tubes, and all necessary Fittings, &c., fitted with Perret's Dust Furnace, with Vertical Engine, and Blower complete.
Also the following VALVES:—
Twelve 16-inch Rack and Pinion Valves, by Donkin.
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All the above are in good condition, and may be seen on application to the ENGINEER, Gas-Works, Waddon, CROYDON.
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One GASHOLDER 80 feet diameter.
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Three PURIFIERS 12 feet square, with 12-inch Connections.
One Good's WASHER, with 12-inch Connections.
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A number of FIRE-CLAY RETORTS, 18 inches diameter, by 9 ft. 3 in long.
HYDRAULIC MAINS, FITTINGS, &c

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c.
CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.
Before placing Orders, please write for Estimate.

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WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
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JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

GAS TAR and Ammoniacal Liquor Wanted.
Apply to JOSIAH HARDMAN, Milton, STAFFS.

FOR SALE, Second-hand — A Station GOVERNOR, 6-inch Connections, and Bye-Pass-Makers, Messrs. Laidlaw (1876). In good order when last working (July this year).
Apply GAS MANAGER, MILLOM.

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FOR SALE—A Second-hand Scrubber-WASHER (Anderson's) with 9-inch Connections complete.
Full Particulars on application to
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FOR SALE—One 20,000 Gallons per hour TANGYE "SPECIAL" STEAM-PUMP, with 9-inch Connections, 10-inch Pump and 18-inch Steam Cylinders, 24-inch Stroke. Being disposed of on completion of Works.
Particulars from
ARTHUR GRAHAM,
Gas and Water Manager.
Mansfield, Dec. 12, 1896.

COMPLETE GAS PLANT FOR SALE.

TO BE SOLD separately, or in one lot—
One large Double-Lift HOLDER, with Cast-Iron Tank, 46 ft. 6 in. diameter by 16 ft. deep, with Inlet and Outlet Pipes.
Two Double-Lift HOLDERS, 34 ft. 4 in. diameter outer, 32 ft. 10 in. inner, 14 ft. 3 in. deep, with Pipes, &c.
One GOVERNOR, SYPHON BOXES, VALVES, &c.
One STATION METER, with Valves (new), Braddock's make.
One Set of four PURIFIERS, 7 ft. square by 4 ft. deep, Walker's make, with Grids and one of their Centre-Valves, Connections, and Lifting Gear.
One TAR-PUMP and STORE BOILER.
One Eclipse WASHER-SCRUBBER, Laycock and Clapham, with Pulleys and Governor, erected in 1890.
One EXHAUSTER, with 12-inch Valves and Connections.
One Horizontal CONDENSER, with fourteen 8-inch Pipes, 18 ft. long, with Bye-Pass, Valves, and Connections.
Twenty RETORT MOUTHPIECES, with Lids and Duplicates, Dip, Ascension, and Bridge Pipes, Hydraulic Main and Valve, Fire-Doors, Buckstaves, and Tie-Rods.
12-inch and 8-inch MAINS, at per ton.
12-inch VALVES, at each.
For further Particulars and Prices, apply to H. I. WILLIAMS AND Co., Kidsgrove, STOKE-ON-TRENT.

THE Directors of the Worksop Gas Company invite TENDERS for the purchase of the surplus TAR and the AMMONIACAL LIQUOR made at their Works from the 1st of January to the 31st of December, 1897.
Tenders for Tar to state price per ton delivered into Purchaser's Tanks at the Worksop Railway Station.
Tenders for Liquor to state price per ton as tested by Twaddell's No. 1 Hydrometer, delivered into Boats near Company's Works, or price per ton delivered into Purchaser's Tanks at the Railway Station.
The Directors do not bind themselves to accept the highest or any tender.
Tenders to be sent in by the 29th of December.
Worksop, Dec. 7, 1896.

TENDERS FOR GAS COAL.

THE Magistracy of Copenhagen are prepared to receive TENDERS for the supply and delivery of 100,000 Tons of best GAS COAL during the Year 1897, from April to the end of December.
The Magistracy reserve the right to divide the Contracts between two or more Contractors.
Further Information and Conditions for the delivery may be obtained on application to the Lighting Department of Copenhagen, Vestre Boulevard, Copenhagen V.
The Tenders (sealed) to be sent to the Magistracy of Copenhagen, Fourth Division, before Dec. 30, 1896, Twelve o'clock.
THE MAGISTRACY OF COPENHAGEN.
Dec. 5, 1896.

ILKESTON CORPORATION.
(GAS DEPARTMENT.)

REGENERATIVE SETTINGS.

THE Gas Committee of the Ilkeston Corporation invite TENDERS for the CONVERSION of Three Beds of Through Retorts at present heated by Direct Firing, into REGENERATIVE SETTINGS.

Full Particulars can be had of their requirements on application to the Manager (Mr. F. C. Humphrys), at the Gas-Works, Rutland Street.

Sealed endorsed tenders, addressed to the undersigned, to be sent in before Jan. 7, 1897.

The lowest or any tender will not necessarily be accepted.

WRIGHT LISSETT,
Town Clerk.

Town Hall, Ilkeston,
Dec. 12, 1896.

BOROUGH OF STOKE-UPON-TRENT.
(GAS DEPARTMENT.)

TENDERS FOR STEEL TANK AND GASHOLDER.

THE Gas Committee of the Stoke-upon-Trent Corporation invite TENDERS for the construction of a STEEL TANK and THREE-LIFT HOLDER.

Drawings and Specifications may be seen, and Bill of Quantities obtained, on or after Dec. 9, on application to the Engineer, Mr. William Prince, on payment of 10s. 6d., not returnable.

Sealed tenders, endorsed "Tender for Gasholder," to be delivered not later than the first post on Thursday morning, Dec. 10, 1896, addressed: F. Geen, Esq., Chairman, Gas-Works, Stoke-upon-Trent.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
J. B. ASHWELL,
Town Clerk.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS, so far as they relate to DEBENTURE STOCK only, WILL BE CLOSED on the 18th inst., and RE-OPENED on the 1st prox.

S. J. WILLIAMS,
Secretary.

63, Chancery Lane, W.C.,
Dec. 9, 1896.

WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of the Company, so far as the DEBENTURE STOCK only is concerned, WILL BE CLOSED on and from the 21st of December, 1896, until the 2nd of January, 1897, both days inclusive.

By order,
CHAS. W. BRAINE,
Secretary.

Offices: North Street,
Wandsworth, S.W.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to the DEBENTURE STOCK WILL BE CLOSED at Ten o'clock forenoon on Friday, the 11th inst., and RE-OPENED on Friday, the 18th inst.

The Interest for the Half Year ending the 31st of December, 1896, will be payable, on the 1st day of January next, to the Proprietors registered on the closing of the Books.

By order of the Board,
JAMES RANDALL,
Secretary.

Gas Offices: Willoughby Lane,
Tottenham, Dec. 4, 1896.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS in respect both to the Four and a Half per Cent. and Three per Cent. DEBENTURE STOCKS WILL BE CLOSED on the 14th of December inst., and RE-OPENED on the 1st of January, 1897.

By order,
I. A. CROOKENDEN,
Secretary.

St. Helen's Place, Bishopsgate, E.C.,
Dec. 2, 1896.

EAST LONDON WATER-WORKS COMPANY.

ISSUE OF £165,000 THREE PER CENT. DEBENTURE STOCK.

MINIMUM PRICE, PAR.

NOTICE is Hereby Given, that the Directors are prepared to receive TENDERS for the above ISSUE (being the third portion of the £500,000 Debenture Stock, created under the East London Water-Works Company's Act of 1894), bearing Interest at 3 per cent. per annum, less Income-Tax, and redeemable after the expiration of 25 Years from the date of issue, subject to six months' notice being given by the Company.

Minimum Price, Par.

Tenders must be delivered at the Company's Offices, St. Helen's Place, Bishopsgate, E.C., not later than Eleven a.m., on Thursday, the 10th day of December ensuing.

Particulars and Conditions, together with Form of Tender, may be obtained at the said Offices, or will be forwarded on application.

By order of the Court of Directors,
I. A. CROOKENDEN,
Secretary.

St. Helen's Place, Bishopsgate, E.C.,
Nov. 5, 1896.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

Now Ready, Price 15s., Limp Cloth, the Sixteenth Yearly

ANALYSIS OF THE ACCOUNTS
OF THE
Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to Gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the Year ended December 31, 1895, or March 31, 1896, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the Year ended December 31, 1895.

Compiled and arranged by
ALFRED LASS, F.C.A.

LONDON:
WALTER KING, 11, Bolt Court, Fleet Street, E.C.

THE "COOMBE" DRAUGHT SCREEN FOR INCANDESCENT BURNERS.

For Illustration and Statement of Advantages to be gained by its use, see "JOURNAL," Dec. 1, p. 1050.

ALFRED ARCULUS & CO., Glass Manufacturers,
BIRMINGHAM.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, $16\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) $13\frac{3}{4}$ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . $13\frac{1}{2}$ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor $94\frac{1}{2}$ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

The Cheapest House in the Trade for
LEVER LOCKS
FOR
GAS-METERS.

Joseph Oakley & Co.
Excelsior Works,
WILLENHALL.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton . . 10,500 Cub. Ft.
Illuminating Power . . 16·9 Candles.
Coke (of good quality) . . 67·5 per Cent.
Sulphur . . . . . 0·58 ,,
Ash . . . . . 2·73 ,,

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 34, OLD BROAD ST., E.C.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For Prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,

FITTER.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED,

— *v* —

"DE MARE" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

— *v.* —

"SUNLIGHT" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, HEREBY GIVE NOTICE, as follows:—

VALIDITY. The Company's Patent has been declared VALID ON ALL POINTS after a Fifteen-Day Trial.

NATURE OF INVENTION. The Invention was described by Mr. Justice Wills as a "PIONEER INVENTION."

SCOPE OF PATENT. The Patent HAS BEEN GIVEN A WIDE CONSTRUCTION; and it was held that the protection given by it was not confined to Mantles manufactured according to the particular prescriptions set out in the Specification.

SHAPE OF MANTLE. The Judge held that a Mantle, even if made in a different form or shape (such as the "De Mare" Fringe or Plume), IS STILL AN INFRINGEMENT of the "Welsbach" Patent.

"DE MARE" JUDGMENT. Judgment for an INJUNCTION, WITH FULL COSTS, has been given against the "De Mare" Incandescent Gas-Light System.

"SUNLIGHT" JUDGMENT. Judgment was given AGAINST the "Sunlight" Incandescent Gas-Lamp Company, Limited, on the question of the VALIDITY OF THE PLAINTIFFS' PATENT.

"SUNLIGHT" MANTLES. Last about 100 hours.

"WELSBACH" MANTLES. Last about 1000 hours.

"Sunlight" Mantles BURN DOUBLE THE GAS to produce the same candle power as the Incandescent Gas-Light Company's Mantles.

Users of "Sunlight" Mantles are applying to the Incandescent Gas-Light Company to REPLACE THEM BY THEIR OWN MANTLES.

WARNING. Users of the Incandescent Gas-Light Company's Mantles upon "Sunlight" Burners ARE INFRINGERS OF THE COMPANY'S PATENT, AND WILL BE AT ONCE PROCEEDED AGAINST.

COSTS. Certificates of the Validity of the Company's Patent have been granted both by Mr. Justice Romer and Mr. Justice Wills entitling the Company to Solicitor and Client Costs, which will, IN ALL CASES, BE RIGOROUSLY ENFORCED.

INFRINGERS. The Incandescent Gas-Light Company WILL TAKE PROCEEDINGS AGAINST ALL PERSONS INFRINGING THEIR PATENT WHETHER

MAKERS,
WHOLESALE DEALERS
RETAILERS,
or
USERS.

Users of the Company's Mantles upon Burners not sold by the Company ARE INFRINGERS.

"LIMITED LICENSE" WARNING. Judgments have already been obtained against such users from Mr. Justice Chitty, Mr. Justice Stirling, Mr. Justice Kekewich, and Mr. Justice North.

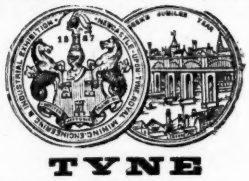
FAITHFULL & OWEN,
11, Victoria Street
Westminster.

Solicitors to the Incandescent Gas-Light Company, Limited.

April, 1896.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.



TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

12, JOHN STREET, ADELPHI LONDON, W.C

PREPAYMENT METERS.

SIMPLE IN ACTION. POSITIVE IN RESULTS.

ROCK METER WORKS,

TELEPHONE No. 2145
Telegraphic Address
AUTOMATIC MANCHESTER

THE Automatic Gas Meter 1895 Corporation Limited

Tariff Street Strangeways

MANCHESTER.

AND AT

49 Queen Victoria Street

LONDON.

ORDERS PUNCTUALLY ATTENDED TO.

GAS COAL.

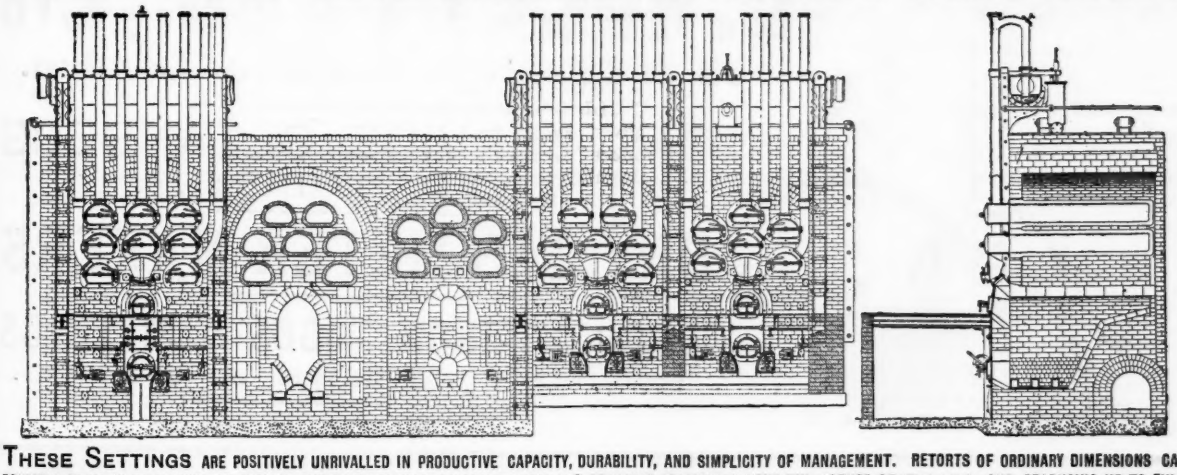
BEST

REAL OLD SILKSTONE GAS COAL,

Address THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Full Particulars may be had on application to the Patentee's Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and Genera Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, 5, Stuart Street, Shawlands, Glasgow, Agent for Scotland and Ireland; and to the Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

The Patentee's SELF-SEALING CAPS FOR THE TOP OF ASCENSION-PIPES, and his "SPECIAL" FLUE PORT BOXES, are most important additions to his Carbonizing Plant.

SPENT LIMES NO LONGER WASTE PRODUCTS.

Under G. R. HISLOP'S Patents, all Spent Limes are effectively recovered at from one-third to one-half the cost of New Lime.
Further Information and Pamphlets from Principal Agent.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

COKE-BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.
GEORGE WALLER & CO.,
165, QUEEN VICTORIA STREET, E.C.,
And at STROUD, GLOUCESTERSHIRE.

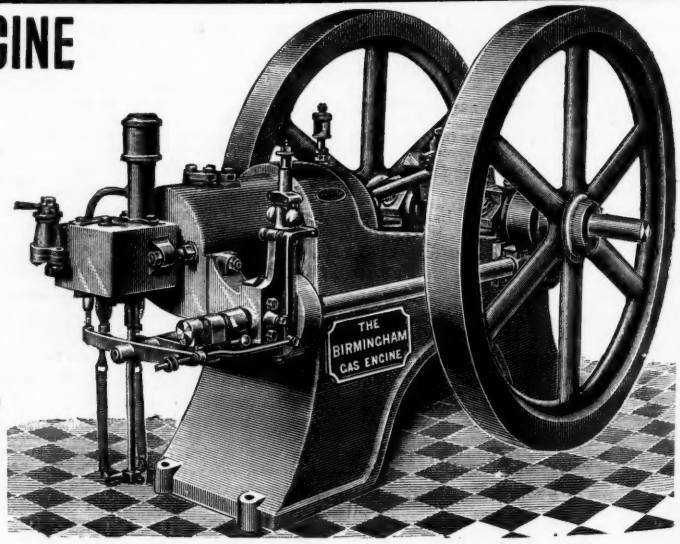
NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

R. & A. MAIN,
GAS COOKING AND HEATING STOVES,
92, ALDERSGATE STREET, KINNING PARK,
LONDON, E.C., & GLASGOW.

JOHN BROWN & CO., LTD., SHEFFIELD.
Proprietors of
ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
ALDWARKE MAIN GAS COAL
Analysis: 12,600 Feet of 19-Candle Gas per Ton.
Value in Pounds of Sperm, 820·80.
VERY FREE FROM IMPURITIES.
TELEGRAMS: "ATLAS, SHEFFIELD."

D. HULETT & CO., LTD.
55 & 56, High Holborn, London.
GAS SERVICE CLEANSERS.
LAMP TORCHES.
DRY GAS-METER MAKERS.
WROUGHT-IRON TUBES & FITTINGS.
STREET LAMPS & POSTS.
PRICE LISTS ON APPLICATION.

THE BIRMINGHAM GAS-ENGINE
"OTTO" CYCLE.
A thoroughly reliable Engine for Commercial or Electric Lighting Purposes. Simple, Strong, Interchangeable.
Adopted by the Corporation of Birmingham Gas Department for Driving the Conveyors at their Swan Village Works.
WILLIAM GRICE & SONS,
Engineers and Founders,
FAZELEY STREET, BIRMINGHAM.
LONDON REPRESENTATIVE: Mr. SAM PUPLETT, M.I.M.E., 47, Albany Buildings, Victoria Street, Westminster.

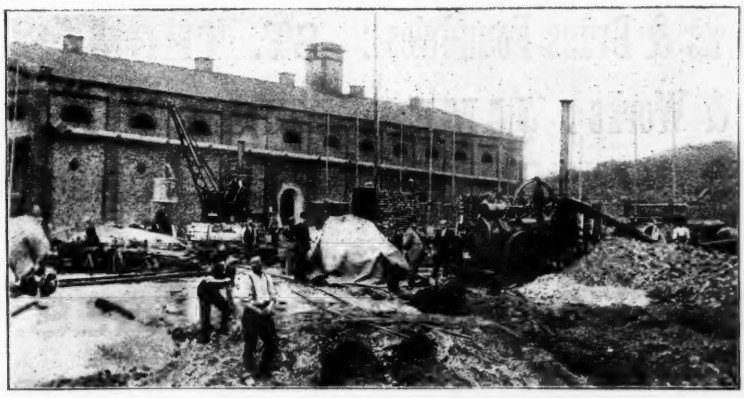


J. & H. ROBUS,

ENGINEERS AND CONTRACTORS,

20, BUCKLERSBURY, LONDON, E.C.

Exchange Telephone: No. 1756 Bank.



Telegraphic Address: "ROBUSTNESS, LONDON."

ESTIMATES SUBMITTED FOR **COMPLETE ERECTION.**

Gasholder Tanks, all Sizes.

Reservoirs all Sizes.

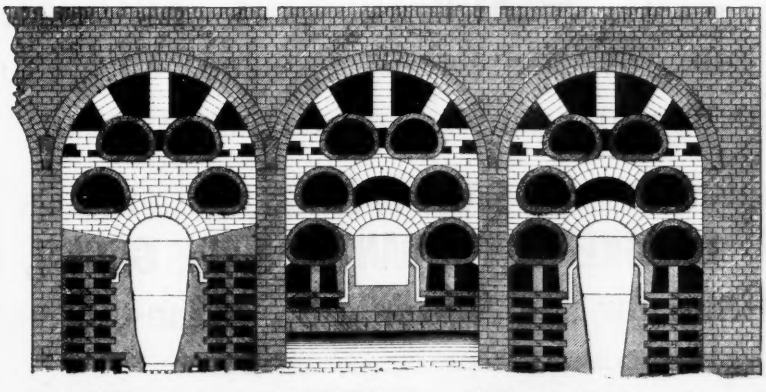
RETORT WORK OF EVERY DESCRIPTION.

SPECIALITY WORK ERECTED COMPLETE.

Renewals.

Re-Setting.

Repairs.



Inclined Retort Work.

Regenerator and Generator Settings.

GAS AND WATER MAIN LAYING.

PLANS, ESTIMATES, AND EVERY PARTICULAR.

WILLEY & CO., GAS ENGINEERS,

CONTRACTORS TO THE GOVERNMENT,

LONDON & EXETER.

Offices: HAVEN ROAD, ST. THOMAS, EXETER.

Engineering Works & Brass Foundries: ST. THOMAS, EXETER.

Meter Factories & Works: JAMES STREET, EXETER; and 248, KINGSLAND ROAD, LONDON.

LATEST SPECIALITIES.

WATER-GAS APPARATUS—A Model Plant in course of erection at their Exeter Engineering Works. Continuous Process; the best Results yet attainable.

COLUMNLESS GASHOLDERS—Makers of Gadd & Mason's Patent System.

Agents for the **MAXIM CARBURETTOR.**

GAS ENRICHMENT in bulk or on Outlet Main.

Makers of the **LIVESEY WASHER.**

Manufacturers of **WET AND DRY GAS-METERS.**

Their Patent **PENNY-IN-THE-SLOT AUTOMATIC METER,** admittedly one of the most perfect in the Market. Thousands in use in London and the Provinces.

Manufacturers of **GAS-FITTINGS** in endless variety—**CHANDELIERS, BRACKETS, PENDANTS, MAIN COCKS, &c., &c., &c.** **SPECIAL FITTINGS** for the Automatic Business.

Metropolitan Agent:

FRANK ACLAND, M.Inst.C.E., M.Inst.M.E., 76, Cheapside, E.C.

Telegraphic Address: "WILLEY, EXETER." Telephone 132. Established over 30 Years.

ALEX. C. HUMPHREYS, M.Inst.C.E. A. G. GLASGOW, M.E.

MESSRS. HUMPHREYS & GLASGOW

Have constructed their EUROPEAN type of

CARBURETTED WATER-GAS PLANT

At the following Gas-Works:—

Copenhagen	700,000 Cub. Ft.	Preston	1,500,000 Cub. Ft.
Belfast	1,700,000 ,,	Southport	750,000 ,,
Glasgow	300,000 ,,	Bath	1,000,000 ,,
Brussels	700,000 ,,	New York	1,200,000 ,,
Liverpool	3,500,000 ,,	Newburgh, N.Y.	350,000 ,,
Tottenham	750,000 ,,	Tottenham (Second Contract)	750,000 ,,
Santiago	400,000 ,,	St. Joseph, Mo.	750,000 ,,
Swansea	750,000 ,,	Brussels (Second Contract)	700,000 ,,
Brighton	1,500,000 ,,	Winchester	200,000 ,,
		Hoylake	125,000 ,,

And have now under Contract:—

Belfast (Second Contract)	4,500,000 Cub. Ft.	Norwich	1,000,000 Cub. Ft.
Shanghai	225,000 ,,	Guildford	350,000 ,,
Manchester	3,000,000 ,,	Syracuse, N.Y.	850,000 ,,
Holyoke, Mass.	600,000 ,,	Bordentown, N.J.	125,000 ,,
Edinburgh	2,000,000 ,,	Lea Bridge	350,000 ,,
Stockton-on-Tees	500,000 ,,	Newburgh, N.Y. (Second Contract)	250,000 ,,
Stockport	500,000 ,,	Coventry	600,000 ,,

In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.

9, Victoria Street, London, S.W. — Telegrams: "EPISTOLARY, LONDON." — *United States Office, 64, Broadway, New York.*

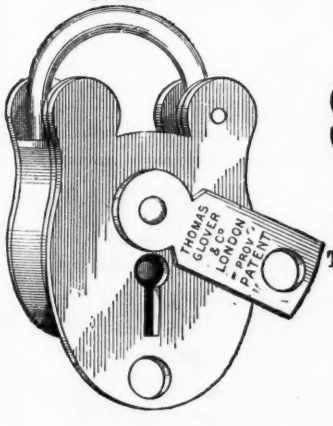
[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS:

The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.

OPEN.



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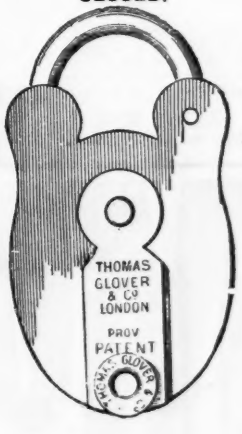

Telegraphic Address: "GOTHIC LONDON." Telephone No. 6725.

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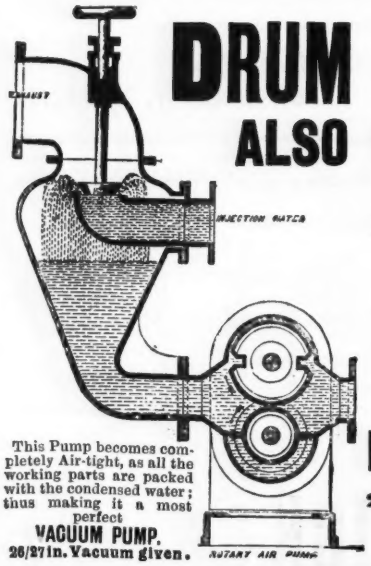
ALSO VACUUM PUMP AND CONDENSER.



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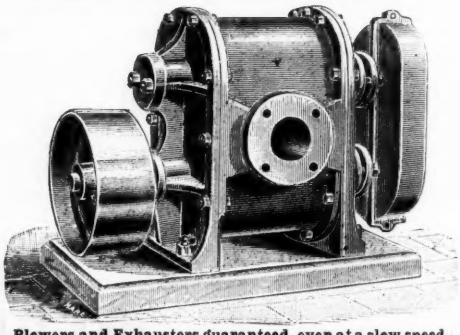

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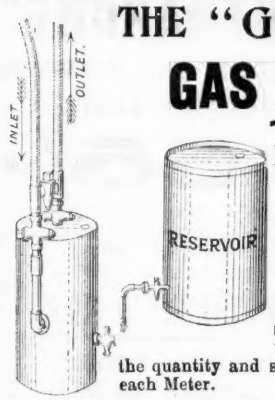

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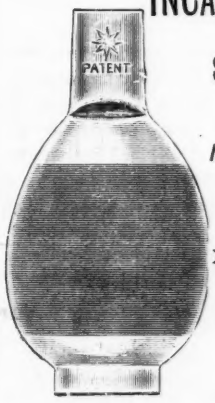

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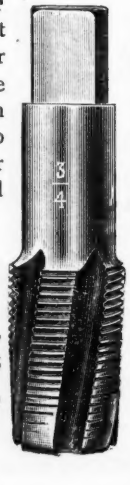

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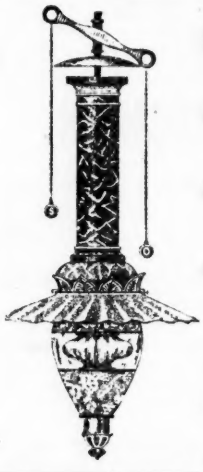

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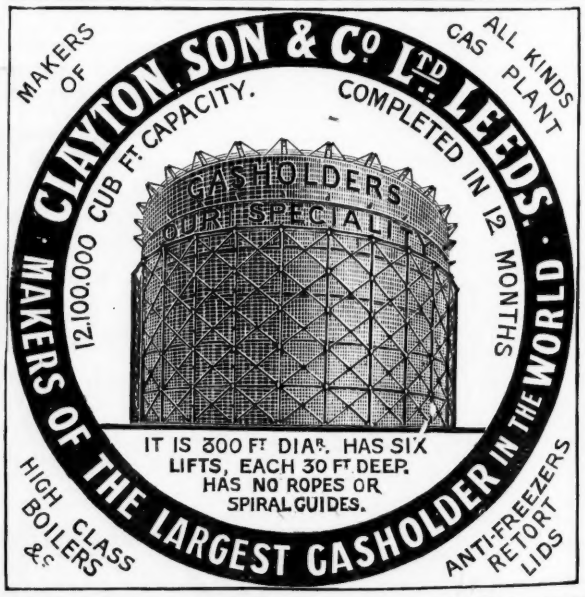
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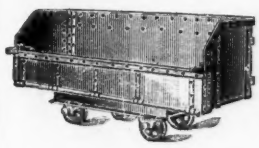

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[See Illustrated Advertisement, Dec. 1, p. 1051.]

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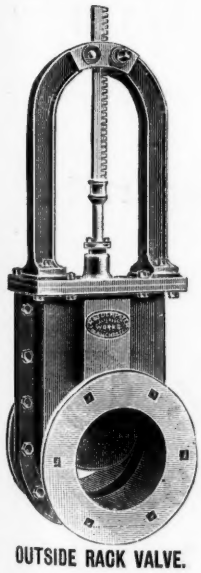

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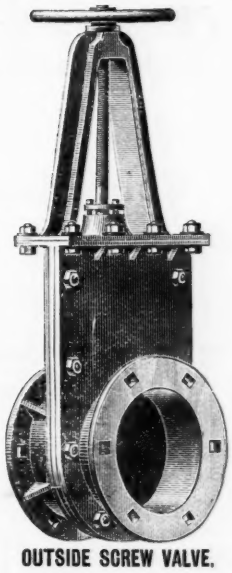

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[See also Advt. p. 1170.

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